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January 2000

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# Viewpoint

With any luck, you are reading this editorial somewhere around the turn of the century. However, I am sitting here in the first week of December writing this, and so I'm going to make a prediction about the so-called 'Millennium Bug':

Absolutely nothing is going to happen.

Nothing. Aeroplanes will keep on flying, traffic lights will continue to run, hydro-electric power stations will continue to produce power, and your toaster will continue to burn toast, as usual.

Yes, the whole world will continue as normal, but not because the Millennium Bug doesn't exist; it does exist, and the problems it could cause would be devastating — were they to happen. They won't happen though, because we're professionals. We've had years of preparation, years of examining potential problems, and years of fixing the problems before they occur.

## Y2K bug? Bah humbug!

Of course there's always going to be the odd VCR that will jump back 100 years and fail to record something, and I'm sure that there's a database somewhere in the world that will insist that someone is -37 years old. But this doesn't really matter, because we know about the problems, and we know how to fix them.

If we lived in the world of E.M. Forster's 'The Machine Stops', *then* I'd be worried. If you've lived your whole life inside an all providing, all encompassing machine environment that never goes wrong, you would rely 100% on the Machine to do everything for you. And that's dangerous, particularly with Human technology.

However we don't live in such an environment, and if you think about it, there is very, very little equipment that is actually mission critical. And if it stops, we fix it. And if we can't fix it, we replace it. And if we can't replace it, we do the job the old-fashioned way with pens and paper, crowbars and shovels.

I'm willing to bet that every responsible person in charge of every piece of automated electronic equipment is more than aware of the problems associated with the year '00'. Furthermore, I'm willing to bet that they've already done something about it, and come up with a workable solution.

The reason I can be so sure of my prediction is that we still don't have machines that work for us: instead, we work the machines. We drive them, we fly them, and (perhaps most importantly), we expect them to go wrong. That's why we backup our files and replace motherboards. That's why we buy solder wick.

So if your PC keels over dead on New Year's Day, take heart. At least you expected it to happen. You'll have backups of all the important files safely locked away, and will be able to pick up from where you left on your newly repaired (or replaced) system.

If your car won't start because its ECM has reset itself, well, you'll get to work one way or another. And if your scheduling software locks up, then you'll arrange that meeting some other way I'm sure...

I suppose I'm modifying my prediction here slightly, in that I'm saying that it will all work out in the end. We might have to perform a quick fix here and there behind the scenes, but to the outside world all that matters is that the planes don't fall out of the sky and the water continues to come out of the tap, and I think we can all manage that, can't we?

***Graham Cattley***

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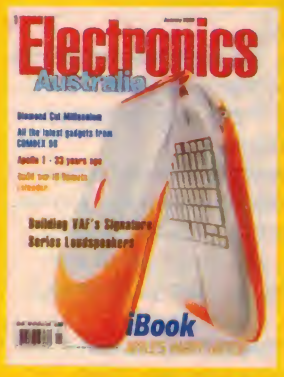
## ADVERTISING INDEX



## ...on the cover




***Oops! My handbag's fallen open... Oh, no it hasn't, it's the latest thing in portable computing from Apple. With it's AirPort wireless Internet adapter the iBook looks to give conventional laptops a run for their money. Check out page 14 for our review of this latest fashion accessory.***

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# Professional Electronics

# Letters to the Editor

## Cant read the screen.

I am another field service technician who like Ray Hildreth (Letters, November 1999) can not read the screen on modern laptops in sunlight. I work in the railway signalling industry in the north west of WA. We use laptops extensively for configuring, downloading and fault finding and it is just so hard to read the screen. Some times just trying to find the mouse pointer can send you spare.

It seems every new piece of equipment we get has a processor and data logger on board with an associated port for the necessary programming and downloading. What we need from the manufacturers is a ruggedised, weatherproof, daylight readable, field technicians laptop.

Now wouldn't that be nice!

***Tony Imoda, Karratha WA (via email)***

## Revolutionary idea

I refer to the article 'Open Fist — 6000 Studies' by Stewart Fist published in the December 1999 issue of *EA*. In this and other articles he has published, Stewart has made a very strong case for the appropriate authorities to really check out the possibility of damage to brain tissue caused by extensive use of the cellular mobile phone system.

I share Stewart's view and I look forward to seeing some action taken about this matter. During my long life as a chartered professional engineer working in radio and electronics over a wide frequency range extending from 15kHz to 5GHz, I have always believed that direct exposure to radiation at the higher end of the spectrum should be avoided wherever possible. In this regard, it is well to remember that modern mobile phones operate at frequencies approaching half those used in early microwave ovens.

However, while the present state of uncertainty exists, why not take steps to minimise the strength of the signal actually reaching the brain above the ear?

For example, by relocating the aerial system at the lower end of the mobile unit, it could be five to ten times further away from the vulnerable area. As the field strength varies as the inverse square of the distance, the radiation reaching the area above the ear would be reduced by 25 to 100 times.

Surely, a reduction of this order would be well worth while and minimise the current concern about this matter. What do your readers think about it?

***W.T. MuscioASTC(RE) SMIREE MIEAust CPEng***
***Leumeah,NSW***

*Comment: I would have thought that this would merely shift the area of irradiation from the brain to the throat (eg. thyroid, larynx etc.). There's nothing special to brain cells that makes them particularly sensitive to EMR... GC*

## C the future

I have to write to you; as a long time reader and professional hardware engineer I have to bring a bit of reality to this debate regarding being an electronic engineer in the current environment. I applaud the enthusiasm of the students that proclaim their desire to be electronics engineers, it reminds me of my thoughts only a few years ago when I was lecturing electronic engineering.

The harsh reality is this: as much as you might love doing electronic design and prototyping, (as I do) it is very mundane after a couple of years. As you students will find, when you get a job you will not spend much time on design. EMC and EMI are a huge part of circuit design and board layout, and without proper education you won't be able to do it.

Circuits are becoming generic and simple. Generally every embedded design has four things: a microprocessor, memory, I/O and a Programmable Logic Device (PLD) to tie it together. Add a ground plane and spark gaps (to pass the Australian design rules) and that's the end of the board design. The Engineer will then spend six months writing code to put in the PLD in a language like VHDL which is so close to C you should just learn to do C!

My point is, Electronic Engineering in today's professional environment is 5% electronics and 95% firmware and PLD design. The firmware is written in embedded C and the PLD written in VHDL (or AHDL), so why get $40-50k and do the same as a Software Engineer on $60-100k? Every professional engineer, not working for universities or the government, will tell you that electronics in Australia is VERY VERY doomed, so for all your sakes I suggest you go do C programming and play on the weekends with your electronics.

***Edward Richards MEng BSc (via email)***

## Are kits still popular?

I have been reading EA for many years and I have noticed that recently there does not seem to be as many projects in the magazine as there once were. At first I thought that it was a deliberate policy on the part of EA but I have noticed that the same applies to other mags, as well as there not being so many shops catering to the kit market. Does this show that the interests of the public is, as always, changing or is it that the shops etc. don't want to bother with small time projects. I personally think that younger people are not so interested in building as much as buying, but perhaps it is something else — perhaps other readers have noticed the trend as well.

***'Old Timer' (via email)***

## MP3 knowhow

Regarding your editorial on MP3s in the December 1999 issue, I don't believe that all your points are totally true. It is true that it is sometimes not possible to find every song ever recorded on the internet, but you can find most of them. All it takes is a little time and knowing where to look.

The world wide web is the worst place to look; you should look for underground ratio-free (you don't have to upload) FTP sites. These are advertised in newsgroups such as alt.music.mp3. I run one of these sites from time to time.

Also look at programs such as Napster, Cutemx, Spinfrenzy and Imesh. These programs allow you to download direct from someone else's hard drive (and they from yours) and yes, they do have good security.

MP3s can give close to CD quality if they are encoded at a high bitrate of, say, 256Kbs, but most people use 128Kbs because of its smaller size and subsequent download time. at 128Kbs the sound quality is good enough to listen to on the computer or record to cd to listen to in the car (but the MP3 must be converted to CDDA format fist). the encoder used to make the MP3 has a lot to do with sound quality as well.

I believe that in the distant future all music will be in a digital audio format like MP3. however it is more likely to be on AAC (Advanced Audio Compression) format instead.

***Michael Douglas (via email)***

## Just a small point...

I'd like to briefly comment on a number of items that have appeared in recent editions of Electronics Australia:

Serviceman (Sep 99): Peter Lankshear's experience with his Hi-Fi exemplifies the folly of operating class 1 equipment without a proper safety earth (signal earth does not qualify!). Mains transformers for Class 2 equipment have to meet more stringent isolation requirements than those for Class 1, so as to permit 'double-insulated' operation. There seems little doubt the transformer Peter is/was using does not meet class 2 requirements.

Webwatch (Sep 99): Graham Cattley states that "...you can't actually buy DOS anymore...". Perhaps Microsoft would like you to believe this, however this is not so. DR-DOS 7.03 is available from Caldera/Lineo and I believe PC-DOS 2000 is available from IBM.

Serviceman (Oct 99):The 40VA Ferguson transformer that Brian Knight attempted to use for his amplifier is neither faulty nor mis-labelled. The rule of thumb is that the smaller or more compact the transformer, the worse it's load regulation. A load regulation of 20% is quite plausible for such a transformer.

Brian's attempt to estimate the load regulation by measuring the secondary resistance failed to take into account the primary resistance and the 'leakage inductance' caused by imperfect coupling between the primary and secondary.

Letters to the Editor (Nov 99): Without taking sides in the EM Radiation / Health Effects debate, I would like to clear up a misconception that G.D. Mayman has, regarding the wavelength of such radiation. While it is true that the propagation of EM radiation through a living organism is slower than through free space, it certainly isn't vastly slower. As for the resonant frequency and wavelength of a watch crystal, this is a mechanical resonance, related to the speed of sound through quartz, not the speed of light (EM radiation).

***Joe da Silva, Croydon, NSW.***

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We welcome contributions to this column, but reserve the right to edit letters which are very long or potentially defamatory.

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# WHAT'S new

## in the ever-changing world of electronics

### AV Receiver has DD, DTS decoding

Denon's new AVR-2800 surround sound 'command centre' follows closely on the release of its new top of the range audio-video receiver, the AVR-3300, offering similar features, including Dolby Digital and DTS (Digital Theatre Systems) decoding, with slightly reduced output (5 x 85W) and at a lower price.

The heart of the AVR-2800 is Denon's Dynamic Discrete Surround Decoder-Digital technology, incorporating high performance DSP chips and superior A/D and D/A conversion devices. In fact full 24 bit, 96kHz digital-to-analog D/A converters on all six channels (three stereo pairs) provides superb listening results, with virtually any home theatre or music source.

Along with the Dolby Digital and Digital Theatre Systems (DTS) decoding technology, the AVR-2800 also provides six-channel external input for connection to future multi-channel surround formats. All five power amplifier channels feature discrete power output devices, providing equal power with lowest distortion. Each channel is rated at 85 watts into 8 ohms, from 20Hz — 20kHz, with no more than 0.05% THD. A hallmark of Denon A/V component design, the equal power amplifiers provide outstandingly accurate reproduction of motion picture soundtracks and multi-channel music programs.

The AVR-2800 has an RRP of $1699 and is covered by a two year nationwide parts and labour warranty. For further information on this or any other Denon product contact info@audioproducts.com.au or free call on 1800 642 922.

### New Panasonic DVD has surround decoders

Panasonic's new high-performance DVD player — the DVD-A360 — is priced at $1099 (RRP) and incorporates built-in decoders for both Dolby Digital and DTS (Digital Theatre System) surround sound. It also incorporates new features that further enhance the excellent quality of the DVD format — Digital Cinema Mode, Digital Picture Mode, and Monitor Select.

For the best in home cinema sound, integrated 5.1 channel DTS and Dolby Digital audio decoders remove the need for expensive external decoders. Surround sound reproduction can be easily achieved by feeding the six channels of output through the user's own multi-channel amplifier and speaker system.

Digital Cinema Mode is designed to optimise playback of film-source software to give the best possible picture, combining brightness control with picture noise cancelling. It also provides a more cinema-like image on non-projection monitors, by lessening the glare associated with direct-view TV screens.

The DVD-A360 is also equipped with Monitor Select, which ensures optimum video performance by allowing the user to select from four modes — Standard (TV), CRT projector, LCD projector and projection TV.

In addition, component video output terminals maintain the purity of the video image during the transmission process, to ensure the highest possible picture quality. A 10-bit video DAC minimises video artefacts for enhanced DVD picture quality.

Dialogue Enhancer, designed for viewing Dolby Digital 5.1-channel movie discs, automatically improves clarity of speech in loud ambient scenes by increasing the volume of the centre channel in relation to the other channels.

The DVD-A360 uses a 96KHz/24-bit audio D/A (digital-to-analog) converter for outstanding sound.

For more information contact Panasonic Customer Care on 132 600.

### 'Personal portable' colour TV

The new Digitor colour portable television from Dick Smith Electronics features the latest in LCD technology with a 50mm TFT screen, and provides viewers with extra bright colours and sharper images.


Perfect for when you're on the move and want to keep up with current events, the set has both VHF and UHF auto tuning and comes with a built-in antenna and stand. It can be battery or DC powered and listened to via headphones.

The Digitor 5cm television has an RRP of $194 and is available from Dick Smith Electronics Australia-wide and Dick Smith Electronics Powerhouse stores at Penrith, Bankstown and Moore Park in NSW and Carnegie and Nunawading in Victoria or via mail order by calling Dick Smith Electronics Direct Link on 1300 366 644 or visiting the website at www.dse.com.au.

## Lightweight projectors also 'super-bright'

Hitachi Australia says its two new data projectors offer the highest brightness levels yet achieved in projector models weighing less than 6.0kg.

The Hitachi CP-S860 is a super-VGA resolution projector (800 x 600 true resolution) suitable for most business multimedia applications, while the Hitachi CP-X960 is a true XGA resolution unit featuring full-screen 1024 x 768 resolution, ideal for projecting detailed drawings and images from more expert applications.

Both models come packaged in one of the smallest and lightest cases — measuring only 291 x 119 x 345mm and weighing in at an impressively light 5.9kg (13lbs). Amazingly both models produce a brightness level of at least 1700 lumens, or around 0.3 lumens per gram, one of the highest efficiency figures ever achieved in LCD data projectors. (The CP-S860 is 1700 ANSI Lumens and the CP-X960 is 1800 ANSI Lumens).

Input signals cover a wide range of PC, MAC and video standards while accessories include a powerful remote control with mouse and laser pointer, and MAC adapter.

The Hitachi CP-S860 is priced at an RRP of $12,950 including tax, while the CP-X960 has an RRP of $15,950 including tax. Both models are available now from Hitachi resellers.

## OOglies — the interactive pet

Dick Smith Electronics has launched a range of new 'interactive pet' toys called OOglies: colourful toys with large bug eyes that change colour as they spin.

The six different OOglies can do many things. When the OOglie is in the mood for a conversation or for 'Fortune Telling', ask it a question and it will answer with statements such as "Hey, Whatever", "No Way", "I Don't Know", "Who Cares?" or "Absolutely".

All OOglies have different sound effects and different tunes when their tails are pulled. Tunes include *Campdown Races* and *Mary had a little lamb*.

When the feet of an OOglie are tickled it will laugh and its eyes will spin and change colour. When the OOglie's eyes have gone red, this means it has gone into 'hyper' mode and it will begin to laugh and vibrate uncontrollably.

There are six different OOglies to choose from, all of which have their own special characteristics.

OOglies are available for $29.50 each from Dick Smith Electronics Australia-wide and Dick Smith Electronics Powerhouse stores at Penrith, Bankstown and Moore Park in NSW and Carnegie and Nunawading in Victoria. They're also available via mail order by calling Dick Smith Electronics Direct Link on 1300 366 644 or visiting the website at **www.dse.com.au**.

## New personal laser printer from Canon

A pioneer in laser printer engines, Canon has now released the LBP800, a versatile and easy to use personal 8ppm (pages per minute) laser printer incorporating Canon Advanced Printing Technology (CAPT), an improved Graphics Device Interface (GDI) driver that delivers improved efficiency and reduced cost.

Through the use of CAPT technology, the Canon LBP800 delivers 'big' laser performance at the personal laser price of $629, making the LBP800 very suitable for small business and home offices where professional quality output is required.

The LBP800 features 600dpi resolution for crisp, clean output and includes Canon's own Automatic Image Refinement (AIR) technology to deliver the equivalent of 2400dpi smoothing for finer edge definition of fonts and graphics. It prints the first page in about 18 seconds and warmup from power-on takes less than eight seconds. The printer allows for face up or down delivery, which is simply selected using a front mounted switch, and comes standard with a 125-sheet multi-purpose tray and single sheet bypass tray.

For more information call Canon Australia on (02) 9805 2000.

# WHAT'S new in the ever-changing world of electronics

## Compact, affordable Mini DV camcorder

Canon Australia has introduced the MV200i, a fully featured camcorder that allows users to experience the quality of digital video and the convenience of the Mini DV system at an affordable price.

Intended for a wide range of consumers, the compact MV-200i features a powerful 16x (and 320x digital) optical zoom lens, Optical Image Stabilisation, a flip-out 120,000 pixel colour LCD screen, video and digital still camera functions, built-in editor, seven digital effects, seven auto-exposure modes and clear, easy to use controls.

The MV-200i weighs only 720g and measures just 76 x 100 x 157mm. The ergonomic design and compact 'palmcorder' styling make it highly portable and suitable for a broad range of experiences such as travel and weddings. A metal lens surround and metallic finish reinforces the high quality construction.

The full potential of the DV system is employed in two PCM audio modes: 16 bit for maximum sound quality or 12 bit, which enables sound, music or narration to be added later. A DV input/output terminal allows the images to be transferred to a suitably configured computer, where they can be edited, sent to family and friends via e-mail, used to create web sites, or simply output to a home printer.

The MV200i kit includes a BP-915 Battery Pack, CA-500 Compact Power Adapter, SS-200 Shoulder strap, WL-D70 Wireless Controller, S-150 S-Video Cable, STV-250 Stereo Video Cable and a 30-minute Mini-DV cassette.

The MV200i has a suggested retail price of $2499. For more information call Canon on 1800 816 001.

## Four-head VCR with Tape Navigation

The new Hitachi VTMX848E is a four head VCR with advanced features usually found only on more expensive units. These include front and back A/V inputs, G-code recording and full shuttle function, and for the first time the inclusion of 'Tape Navigation' previously found only on Hitachi's top-of-the-line VCR.

Tape Navigation quickly takes a user either to a pre-recorded program on a tape or automatically finds a suitable blank spot for a new recording, on a tape previously recorded on that individual VCR. It does this by storing all the information (including date, channel, start time, record period and mode) for up to 200 individual program recordings, within a processor in the VCR and displayable on-screen at the touch of a remote button.

The Hitachi VTMX848E also includes a Close Caption Decoder feature, permitting the display of captions or sub-titles on a tape recorded with this information — great for the hearing impaired or those wanting to learn another language.

RRP including tax for the VTMX848E is $369.00.

## CD auto changer with HDCD decoder

The new Denon DCM-370 CD Auto Changer with HDCD decoding provides outstanding results when used with standard CDs. But its integrated HDCD (high definition compact disc) decoder takes CD sound performance to a new level when a CD recorded in the HDCD format is slipped into the newly developed five-disc carousel changer.

The HDCD decoder and the smooth, quiet changer combine with other features like a coaxial digital output and remote control interface to make the DCM-370 a versatile, high performing component of any quality home entertainment system.


As part of the new technology, the DCM-370 incorporates a multilevel noise shaping DAC. This multi-level modulation removes the adverse effects of jitter, and because it is built into the output amp, simply means the unit delivers a clean analog output with suppressed high-frequency interference. It also includes an 8-times oversampling digital filter that provides an extraordinary degree of attenuation and reduces frequency irregularities in the audio range to an absolute minimum.

The DCM-370 CD Auto Changer is available now from selected Denon dealers, is covered by a two year nationwide warranty and has an RRP of $475. For more information call AWA Audio Products on 1800 642 922 or contact info@audioproducts.com.au.

## Sleek new mini from Philips

The new Philips MZ-7 mini system is claimed as the most sleek looking mini system on the market, with silver and woodgrain speakers that pump out an impressive 2 x 50W RMS stereo. Philips says it delivers all the thumping bass you could ever want from a mini system, with a three-way bass reflex speaker system. Detachable speaker grilles allow you to change its looks when desired.

A feature of the MZ-7 is a seven-band Spectrum Analyser with four display modes. It's also CD-Rewritable compatible, which means you can play both CD-Recordable and CD-Rewritable discs, such as those created on the Philips CDR765 Dual Deck CD Recorder.

Other features include a three CD changer and 6.5" G-cone woofers. You can also upgrade to heavier bass, as the unit is Subwoofer Ready.

RRP of the Philips MZ-7 Mini System is $769. For more information call Philips Electronics on 1 300 363 391 or visit their website at **www.philips.com**.

## Hi-res 42" plasma display

Hitachi Australia claims its new High Definition Flat Panel Display (HDFPD) offers the highest resolution and definition yet seen in large panel screens. The displays incorporate leading-edge Plasma Technology with Hitachi's own developments to vastly improve image quality.

The first HDFPD released from Hitachi is the 42" model CMP402HDU, with a wide range of computer and video inputs and claimed ideally suited for shopping malls, call centres, showrooms, digital art on walls, dealing rooms, reception areas or business presentations. In fact, anywhere that large, high quality multimedia material needs displaying.

The CMP402HDU incorporates Alternate Lighting of Surfaces or ALiS technology, a new plasma screen technology that alternately lights odd and even lines, ensuring a higher definition and brightness than conventional Plasma panels. Hitachi claims that the 105.95cm (42") diagonal screen can display an amazing 16.7 million colours at a typical brightness level of 250cd (candela), all at a resolution of 1024 x 1024 with a contrast of 350:1 — easily the best in the industry.

Hitachi has built-in 28 different input modes, so that the display will accept a huge range of multimedia inputs from VCRs, DVDs, professional video and digital broadcast equipment as well as PCs and Macs.

While big on size, the Hitachi CMP402HDU is small on space. Weighing only 33.5kg, and only 89mm thin, the unit is very suitable for mounting on walls, ceilings or desks and the extra brightness ensures images can be viewed even in the brightest room. A super-wide viewing angle of 160° in the horizontal and vertical plane ensures that the image does not suddenly disappear as the viewer moves around the room.

The Hitachi CMP402HDU is now available from selected retailers around Australia for an RRP of $26,699 including tax.

# WHAT'S new

## ...at the 1999 COMDEX Show


### Internet, fast and simple

The e-Mail Station is one of the Web appliance range from V Tech Industries Internet appliances. They are typically inexpensive devices (most costing around $200) that connect to the Internet and focus on a few specific functions, such as downloading music, getting stock quotes, scheduling meetings, updating personal calendars, Web surfing and e-mail. They don't have disk drives, and are not bundled with productivity software other than a Web browser. They are completely silent and connect to the Internet almost instantly at a touch of a button. They will appear on US store shelves this spring.

### Making a noise

Faster, quieter, and cheaper are the points that have driven the computer printer business over the years, but the Financial Literacy Centre made a big splash at Comdex with the slowest, loudest most expensive printer at the massive show.

FLC introduced a replica of the Edison Universal Stock Ticker. It was Thomas Edison's first invention that was actually a commercial success. The $3,500 working replica can connect to the Internet and print out stock prices. Its a must-have for the online trader who has everything...

### MP3 players aplenty

The 'Rush' MP3 player from Philips, like many of the other MP3 players on show offer 32 megabytes of Flash memory, enough for one to two hours of recorded content.

Other MP3 players included the D'music series from Pine in Hong Kong, which now comes in see-through pink, green and blue. The US$249 model includes 64 megabytes of memory.

Sony showed off its new Music Clip, a 4.7-inch long, 64-megabyte device built around the company's new Memory Stick that holds up to 120 minutes of downloaded music. The US$299 Music Clip runs on two AA batteries and will be available this spring.

C-One Tech showed off its 1-ounce digital player, MP Wow, a wristwatch-size gadget expected to go on sale over the Internet in the U.S. in time for the holiday shopping season. The $169 model can store around 4 songs.

Creative Labs in Silicon Valley displayed its Nomad 2 digital player that includes a backlit screen for displaying title, track and other information. The system will be priced between $300-$400 and have 32MB of memory.

One negative market trend affecting the sale of MP3 players is the rising cost of computer memory, which is threatening to price the devices out of range of millions of potential buyers. The price of the average player is starting to exceed twice that of more traditional CD-based machines such as the Sony Discman.

## World's first 1GHz computer

Comdex may have lost some of its former shine, but the event remains the premier launch point for new products and technologies related to the personal computer industry.

Ironically, for much of the past decade, one of the last things that draws any interest at the world's largest personal computer show are desktop personal computers. Significantly, higher performance is pretty much expected, and few PCs offer features that truly distinguish one from another.

Each year however, there are some machines that do attract a crowd. This year, that certainly was true in the KryoTech booth, where the company put its new Super G system on display, the first PC with a 1GHz microprocessor.

The Super G system combines the practice of over-clocking the microprocessor and a heavy dose of cooling technology. The Super G is powered by a 700MHz Athlon processor from AMD, and it is encased in a hermetically enclosed cooling system that brings the temperature of the chip down to -40 degrees. As a result, the system operates at clock speeds averaging more than 1000MHz.

Another class of PCs that drew some attention are those following in the footsteps of the Apple iMac by using innovative design styles away from the stale beige PC box.

Korea's Daewoo introduced a line of visually interesting machines with names like Luxor, NetTeen, and Argo. The machines use Intel's FlexATX motherboards and offer USB.

## 5th sense for your PC

The 5th sense personal authentication system from Veridicom lets users access computers and files after passing a fingerprint test. Veridicom (www.veridicom.com) showed off its personal authentication peripheral for fingerprint-based authentication, which is the size of your average (computer) mouse. It will enable computer users to grant access to a computer system or individual files based on matching the user's fingerprint with one stored in memory.


## DVD drives with the lot

Finally, recordable DVD technology is just around the corner as Philips demonstrated its prototype of their 4.7 gigabyte DVD+RW technology.

The first DVD video recorders are likely to be in consumer electronics stores around Christmas of next year, promised Robert van Eijk, vice president of Philips Optical Storage.

Competing with the Philips solution will be Panasonic's DVD-RAM drives, which offer 5.2 gigabytes of storage capacity, enough for recording 230 minutes of MPEG-2 video or eight hours of CD-quality audio. Panasonic introduced the D102U DVD-RAM, which has a list price of around US$800. The drive can read DVD video, DVD-ROM, DVD-R, Video-CD, CD-Audio, CD-ROM, and CD-R/RW disks.

## Handy scanner

This handheld scanner will read in lines of text, and upload it to your PC via cable or infrared wireless connection. You simply move the tip of the pen-like device over the page, and the scanned in sections are converted to text via a built-in OCR engine. The QuickLink Pen from Wizcom will retail for around US$150 in the United States, and it can store up to 1,000 pages worth of text in internal memory. ❖

# iBook, Therefore I Roam

**Apple's iBook is "The ultimate, itinerant, powerful and mobile communicator", according to Barrie Smith who got his hands on one to review. The trouble is, we don't think he's going to give it back...**

*by Barrie Smith*


At the outset, I must confess to being an earnest denizen of the desktop; my daily hours are spent locked within an arm's reach of a high level Apple Mac, and a screen so large and heavy it will probably still be here when I totter off this mortal coil or the great flood arrives.

So, when the opportunity arrived to test drive the radical new laptop from Apple — the iBook — you could say 'mixed feelings' were close at hand. My work life is relatively 'unmobile'. Do I need a laptop?

Nine or ten years ago Apple set out to appeal to the dollar-challenged with a budget line of desktop models, christened the LC; the flat, featureless system quickly won the nickname of the 'pizza box'.

Now, with the introduction of the Macintosh iBook, I am here to tell you that Apple have belatedly delivered the 'pizza' — resplendent with near edible colour schemes and a flat, brightly coloured, round cornered, Frisby-like casing.

So it's just another laptop, you say. Well, no it ain't, for a number of reasons. The most important of which is the AirPort wireless-free roaming connection system available as an option with the iBook and the company's new desktop models.

You also get a choice of two colours — tangerine and blueberry — some free software, a 12.1 inch high-res active-matrix TFT display, and a natty carry handle that folds away out of sight. And with an internal 56K modem, plus an external modem port, plus 10/100BASE-T Ethernet and USB ports, it's ready to hook up to most peripherals. However, looking towards a simper future, Steve Jobs has spoken, so there's no floppy drive, and no SCSI connection.

## Up with the Lid

In technology terms, the processor is a rippingly fast 300MHz PowerPC G3 CPU; for its part, the body is made from crash resistant polycarbonate, while the design briefing obviously sidestepped any external projections, corners or latches.

To carry the iBook, first reach for the handle, tucked into the base of the computer, sharing the body's hinge and opening out to form a shallow loop.

To use, first slide a deft fingernail under the lid's leading edge and lift up to reveal the treasure chest that is the iBook.

In its raw nakedness, the screen and keyboard could easily be mistaken for a make-up kit — soft off-white, relieved by hot tanger-


## iBook Specs

300MHz PowerPC G3 processor with 512K backside level-2 cache on a 66MHz system bus.
32MB of SDRAM.
3.2GB IDE hard disk drive.
Screen: 12.1" (30.6cm) TFT SVGA active matrix display, 640 x 480 pixel and 800 x 600 pixel resolution with millions of colours.
Built in 24 speed CD-ROM drive.
Lithium-ion battery with up to six hours of operation.
Size: 34.4 x 29.4cm.
Weight: 3.0kg.

**AirPort specs**
Wireless data rate: Up to 11Mbps range. 50 metres in typical use (varies with building construction)
Frequency band: 2.4GHz.
Radio output power: 15dBm (nominal).
Compatibility: IEEE 802.11HR Direct Sequence Spread Spectrum (DSSS) 11Mbps and 5.5Mbps draft standard. IEEE 802.11 DSSS 1 and 2Mbps standard.

**Good Points**: Easy to open, instant power on. A supremely portable, one piece office — with phone 'to go'.
**Bad Points**: Stridently visible colour scheme bound to appeal to the light fingered segment of our population. Solution: hide the iBook in a pizza box!
**Price**: $3,295. The AirPort Card is a $195 option. The AirPort Base Station is $595.
For more information:
Phone Apple on 133 622, or visit **www.apple.com/store**.

ine or icy blueberry accents. Your hand first rests on the trackpad close to the leading edge; to tap out a message on the keyboard (set dead amidships) your fingers must travel 11cm inboard — quite a distance, but this means your palms have a natural resting place, helping stave off RSI problems. At the far edge of the keyboard area is a power button and a small speaker enclosure. And that's it.

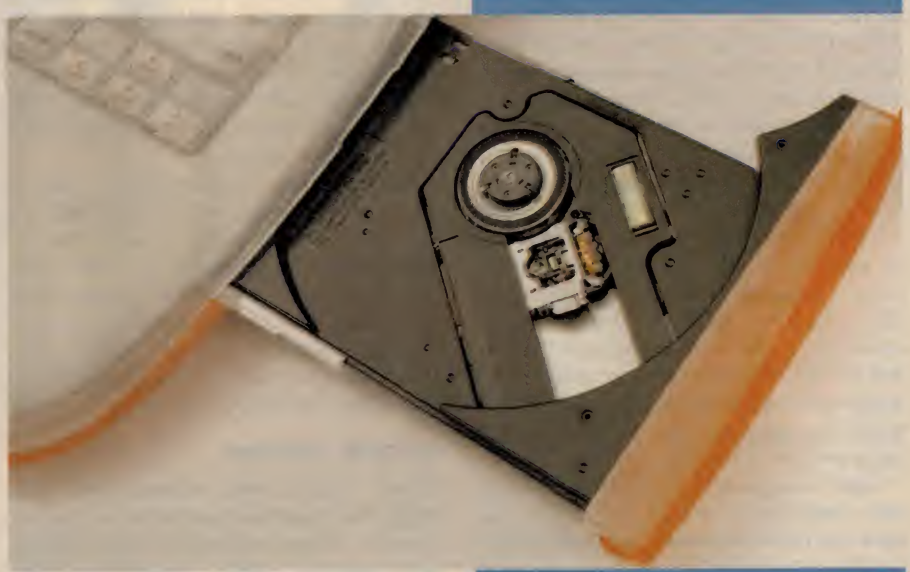
Once powered up, you can get to work, driving the screen cursor with your forefinger tip and confirming the selection with a gentle pressure from your thumb. Macs use single button 'mouses' so the pressure confirmation pad on the iBook is a simple, single pressure zone.

The screen itself is a revelation. In my day-by-day activity of reviewing digital cameras for a national magazine I have probably viewed more colour LCD screens than Eskimos have eaten icy poles. And all, without exception, are unviewable in full daylight. But not this one: even with full sun shining on its surface the data and diagrams on screen were clear and legible, whilst admittedly colour desaturated; under a more favourable office interior illumination the view on screen could not be bettered, rivalling a computer CRT display - even photographs came up bright and sparkling.

Run your eye down the left edge of the iBook and you discover the phone (modem), Ethernet and USB ports as well as a headphone socket; the right edge houses a power

***The quality of the iBook's LCD screen is excellent - it's even legible in bright daylight.***

***There's only enough space for a bare-bones CD drive.***



*Flat as a pancake when it's closed (less than 30mm high), the iBook automatically powers up when you open it.*

input for mains current operation or (simultaneous) battery charging.

The CD-ROM drive is also located on this side; a quick jab and it opens up to reveal a bare bones loading tray, exposed mounting spindle, laser and drive track. No mistake! This is where the CD drops on.

## Work done, power down

And once more the inimitable Mr Jobs raises his hand. In his view a laptop should be a 'get up and go' piece of gear — open it up and she goes, close it down and she stops ... says Steve.

Which is how the iBook operates. Open the lid and the screen flashes into action, ready for data input. Close the lid and the iBook powers down into a very, very low energy state. Naturally, in these energy conservation conscious days, there is a (settable) system control panel which kills the power supply after a preset period of CPU inactivity.

Imagine the meeting: high powered exec walks in, slips iBook on the board room table, lifts the orange and white lid - and up comes the screen display, right on the pie chart or spreadsheet! Applause from the assembled attendees.

## AirPort

The iBook is more than a one trick pony, but in fact with AirPort communication this one trick would have been more than enough to excite the punters when the device was first announced.

Each day as we bruise under the weight of words from such wizards as Telstra, Microsoft and Oracle persuading us that data exchange on the move will be the way of the world tomorrow and the next day, it looks more and more likely that our mobile phones will soon assume important roles as virtual interchanges.

The iBook, with its 56K internal modem and AirPort, sit right there, allowing wireless Internet access direct from the laptop to the rest of the globe. With the AirPort card installed in the iBook your data output can be sent and received by the AirPort Base Station anywhere within a 50 yard radius, even through walls, allowing Internet access anywhere in the home, classroom, office. The AirPort Base Station is a small device similar to the base station of a cordless telephone that plugs into your telephone outlet, cable modem or Ethernet network.

Inbuilt is password protection and encryption capabilities to ensure security for your data and communications. The performance is high: an 11Mbit/second data rate compares favourably with the claimed USB speed of 12Mbits — sufficient not only for modem transfers but, it would seem, adequate for output to a printer. A Mac and AirPort would be a powerful tool to set up your own LAN (Local Area Network) as well.

With networking, one of the greatest challenges facing schools is existing facilities. Many schools must address asbestos issues, inflexible wiring configurations, or architectural details that need to be protected. In these cases, AirPort eliminates the need to run Ethernet cabling into every classroom. Simply by locating a base station in a lab or hallway near a classroom, you can provide wireless networking to iBook computers throughout the school.

Instead of running more Ethernet cable in the room, educators could simply place an AirPort Base Station near existing Ethernet cable and a power outlet to extend the Ethernet network. Then students using iBook computers can collaborate more easily on projects, because they can move easily about the classroom without having to disconnect and reconnect cables.

## Simple Internet

Recent desktop Macs, especially the iMac range, have boasted a dead simple, no fuss, no clamour, Internet connection routine. Having spent laborious, painful, confusing days and days some years back setting up my own desktop Mac for Internet use, and not having spent much time with the iMac, I tried out the iBook with some high degree of scepticism.

As I already have an account with a well-known ISP, the requisite phone number, user ID and password details were already to hand. So I set about to fire up the iBook's Internet Setup Assistant and type in the numbers, passwords etc as the software asked. Job complete in a few minutes. The software's happy. I am happy.

Then to Netscape Communicator, I fired it up and the iBook dialled the ISP's phone number, passed along my ID and password info — and there I was — on the Net!

It works! A simple Internet hookup!

## The hook

So, after a too-short week spent with the iBook, sharing it with family and friends — do I need a laptop? A most resounding yes, if I can hook into a wireless modem connection, link to printers, scanners etc. As Louis once sang, what a wonderful world (read 'office') it would be ... without serial and USB cables and other sundry peripheral connectors to tangle with.

The simple to operate iBook concept and the brilliant AirPort comms scheme could well infiltrate into office and schoolrooms across the country, dispensing with wires, cables and sundry connectors by the truckful.❖

# MicroGram Computers

## Infra Red Serial Link

This easy to install IR adapter connects to the serial (COM) port of the PC and provides wireless data transfer between desktop PCs and mobile computing devices that have a built in IrDA infrared port.

Cat. 8421 Infra Red Serial Link $99

## PCMCIA 10/100Mbps Ethernet Adapter

The PCMCIA Ethernet card is a credit card size Ethernet adapter that connects a notebook PC to an IEEE 802.3 standard Ethernet network. It features 16-bit PCMCIA architecture and automatically negotiates 10 or 100Mbps connection rate, depending on the speed of the network.

Cat. 11300 PCMCIA 10/100Mbps Ethernet Adapter $159

## SCSI HDD Controller Cards

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Cat. 2693 HDD Cont. PCI SCSI-III Ultra2 Wide $475

Also available,

Cat. 2585 HDD Cont. ISA SCSI-II Fast 16 bit $89
Cat. 2584 HDD Cont. PCI SCSI-II Fast $109
Cat. 2587 HDD Cont. PCI SCSI-III Ultra Wide $249

## Smart Card Reader/Writer - Serial

Identical in size and feel to credit cards, smart cards store information on an integrated microprocessor chip located within the body of the card. The Smart Card reader/writer connects to the PC via a serial port and takes power from the keyboard port with a T type cable. The reader is compliant with ISO7816/3 with T=0,T=1 and APDU protocols. A software library for DOS, Win95/98 and WinNT4.0/2000 is included.

Cat. 8899 Smart Card Reader/Writer - Serial $169

## Multi I/O ISA Card

A versatile interface card that supports 2 FDD, 2 HDD As well as 2 16550 compatible serial ports, 1 ECP/EPP printer port and 1 games port.

Cat. 2055 Multi I/O Card $50

## Web-Based Training from $14.95 per month*

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*Full details at www.tol.com.au

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## POS Cash Drawers

These POS cash drawers feature robust metal construction casing and a pearl white ABS fascia with a slip deposit slot. The bill tray is of heavy duty ABS construction with adjustable dividers for four or five compartments along with spring loaded bill clips. A separate coin tray, removable from the bill tray, has adjustable dividers for up to nine compartments.

Cat. 8897 POS Cash Drawer -Epson/Star Emulation $209
Cat. 8898 POS Cash Drawer - RS232 $239

## Bar Code Laser Gun

This new laser gun scanner has a built-in 4-in-1 decoder so that switching between interfaces is just a matter of changing cables! With innovative head design, the laser head can be bent (33 degrees, 5 steps) which means you can adjust the laser beam pitch angle to the most comfortable position, instead of twisting your wrist. The A-Shot laser gun is equipped with an Metrologic 100 scan/sec laser module.

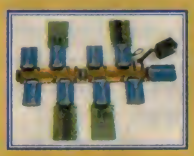
Cat. 8767 Bar Code Laser Gun Auto KB Wedge PS/2 $599
Cat. 8770 Bar Code Laser Gun Auto KB Wedge AT $599
Cat. 8771 Bar Code Laser Gun Auto Serial $599
Cat. 8772 Bar Code Laser Gun Auto Stand $35

## Remote Power Control Kit via Internet

Control computers, swimming pool pumps, security lighting, heating, cooling etc. over an intranet or the internet. The kit includes a PCI PnP Digital I/O interface card, power control box & eight-in-one connecting cable. Fully functional demonstration software, with source code in VB and C++, is included as well video monitoring software.

Cat. 17064 Remote Power Control Kit via Internet $579

## Parallel Port Data Acquisition



A range of high precision, parallel port, data conversion modules which are ideal for laboratory research, industrial process monitoring and control. The series includes A/D converters & digital I/O modules as well as terminal boards & an expansion kit with 5 sockets to allow support for up to 16 modules. The digital I/O module has 8 digital inputs & outputs and can be connected to an eight opto isolated input & eight reed relay output board.

Cat. 17031 12-Bit A/D Converter 0 - 10V $239
Cat. 17032 12-Bit A/D Converter 0 - 5V $229
Cat. 17033 A/D Terminal Board $102
Cat. 17034 Digital I/O $209
Cat. 17035 8 Opto 8 Reed Relay $219
Cat. 17036 Expansion Kit $109

## FireWire to PCI Host Adapter

Connect your digital video camera to your PC. Our Firewire card allows IEEE 1394 FireWire devices (most digital camcorders available today) to connect to your PC at speeds up to 400Mbps. The card has three external and one internal 1394 connection ports to allow connections to hard drives, scanners, VCRs, HDTV, printers etc. Editing your videos is simplified with the bundled Ulead Video Studio DV SE software.

Cat. 2621 FireWire to PCI Host Adapter $199

## Pressure Sensitive Pen Tablet


At last an affordable pressure sensitive pad with an active area of 146 x 108mm. Two buttons on the stylus pen enable you to simulate clicking on the right, left or middle button of a 3-button mouse. It is sensitive to 512 pressure levels which allows you to vary line width according to pressure using your favourite application software (Photo Impact 4 Light software included). The tablet has a default resolution of 508 lpi, but can be set up to 4064 lpi.

Cat. 8896 Pressure Sensitive Pen Tablet $169

## UPS & Power Supply

It's not just a UPS but also a 300W power supply. The UPS is actually built into a standard size power supply and the batteries & front panel occupy a 5.25in drive bay. The UPS is rated at 500VA. Apart from power failure, the UPS also protects against over voltage, under voltage, overload & DC short circuit. Optional software provides for automatic shutdown.

Cat. 8588 UPS / PS (ATX) Int 500VA/300W $439

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# Electric bushwalking with GPS


**In this second part of our look at Global Positioning Systems, Tom Moffat covers the more practical aspects of using a GPS out in the field (as it were).**

*by Tom Moffat*

I didn't intend to become a GPS user, I really didn't. I kind of got sucked in, as they say. Here's how it happened: During my many years in Tasmania I got right into bushwalking. Now I'm on the Olympic Peninsula in the USA, home of Olympic National Park, one of the most spectacular and rugged parks in the world.

When the walking bug bit again, I headed for the local outdoor shop to get a map for an area I'd picked out, with easy walks to get started again after a couple of years of laziness. The map cost me $5.00, but it didn't bear any relation to the area it purported to represent. Tracks I knew about weren't on the map, and tracks on the map didn't exist. I soon found out why: the map was printed in 1953.

In Tasmania I'd grown used to the excellent Tasmaps series of 1:100,000 and 1:25,000 maps covering the whole island. I went back to the outdoor shop, demanded a refund for the 1953 map, and asked for some more modern topographic maps. "They don't make those in this country", I was told. The truth was, that shop, being in a small town and having no competition, couldn't be bothered stocking proper maps.

One day I found a brochure inserted into a magazine, advertising a CD- ROM with digitally scanned maps in both 1:100,000 and 1:25,000 scale, covering entire national parks. These were the Maptech "Take-a-hike" series, so far available for only six out of the hundred or so national parks in the USA. And our Olympic National Park was one of those selected.

The CD-ROM cost $30, and it included a software program called Terrain Navigator for viewing and printing the maps. I'd seen other bushwalkers carrying a custom-printed topo map of where they intended to go on that trip. The track was highlighted nice and heavy to make it stand out, easy to follow.

So I coughed up my $30, and discovered I now owned ninety-eight 1:25,000 maps and seven 1:100,000 maps, just as good as my trusty Tasmaps which, as I remember, cost about $5 apiece. That's over $500 worth of maps on a $30 CD- ROM. I soon learned to use Terrain Navigator's 'track tool' to colour-in the track to some destination, and then print out the map. That sheet of paper could fold into pocket-size, and after returning from a walk with the map wet and/or sweaty, I could just toss it into the rubbish bin and print out a fresh map for the next trip. This arrangement worked very nicely indeed.

On the menu bar along the top of Terrain Navigator's screen was an item labelled 'GPS'. It had selections such as 'Connect to

GPS' and data transfers 'GPS to computer' and 'Computer to GPS', and another item simply labelled 'Track'. Any gadget for connecting to a computer will usually snag me sooner or later, and before long I was on the internet finding out everything I could about GPS, and in particular how it could be applied to a computer. Soon I'd placed an order, for a Garmin 12XL model which appeared to be the most popular unit in the USA. There went another $200, all because of that Maptech CD-ROM.

## GPS in the real world

GPS is a complex technology with a simple purpose: to tell you were you are, and guide you to where you would like to be. Positioning information comes entirely from satellites; there is no dependence on the earth's magnetism as with a traditional compass, and with GPS you can fly blind — as long as you can see the GPS receiver's display screen, you can navigate, even with zero visibility.

I can think of a couple of times in the past that GPS would have made life a lot easier. Tasmania's Walls of Jerusalem National Park is normally entered from the north, but for Hobart people that means a five hour drive before you can even start walking. There is another plan of attack, up through Bothwell to the Central Highlands, then along past Lake Augusta, leaving the cars near Lake Ada. Then you walk across barren and unmarked terrain to just the right spot along a bluff from where you can drop down into the centre of the park at Dixon's Kingdom. This route cuts the car drive to one hour, and there's not a lot more walking involved.

One would think this would be a simple map-and-compass navigation exercise, except for one problem: the whole area is riddled with ironstone, and compasses are horribly inaccurate — just about useless, in fact. On our first trip along this route we followed the compass anyhow, thinking maybe it was just a little bit inaccurate. And instead of the nice easy flatlands, the compass led us along ridges strewn with fallen logs and mud bogs and much other unpleasantness.

**With GPS There is no dependence on the earth's magnetism, as with a compass...**

Eventually we decided to forget the compass and instead use our 1:25,000 Tasmap to match small lakes on the map with similarly shaped lakes on the ground. This worked, and got us almost exactly to our destination. But it was slow, with all the stops and searching for particular lake shapes on the map. Had we had GPS we could have set our bluff as a destination, and then simply followed the arrow right to it.

Another trip: a climb up Mt. Maria on Tasmania's Maria Island. This is fairly routine open forest walking, followed by a rocky scramble to the summit. Somehow we lost the track, but scrub-bashed to the summit anyhow. Then the fog came in and all visibility was lost. We had no idea which way to go to get off that mountain, and only succeeded when we blindly stumbled upon the track we'd lost originally.

With GPS we could have recorded our own 'track log' as we headed up the mountain, and simply followed it down backwards to get home, even though visibility was almost nonexistent. The Garmin GPS has a 'track-back' feature, just for such contingencies.

GPS travel isn't for every purpose. It's pretty useless in deep forest where there are lots of trees, but in forest there's usually a well-defined walking track that's easy to stick to. (And besides, bashing through the woods is too much work, just to be eaten by cougars.)

On the other hand, GPS works great in open country, such as Tasmania's Central Highlands, where tracks may be indistinct or nonexistent.

Sometimes GPS is used just for fun. In fact information on the internet suggests there is an entire hobby built around GPS-ing. You can go for a walk through town and let the GPS receiver record where you've been and how far you've gone (10.8km for me this morning). It's also possible to mount a handheld GPS onto a bicycle. Thus it can guide you, and keep a record, of a two-wheeled trip around town or across the country.

## Let's go bushwalking

During a walking trip, particularly into unfamiliar territory, you can let the GPS lead you, or at least use it to check your position and progress from time to time. But keep in mind that the GPS receiver is an electronic gadget containing a computer, and as such it could very well go on strike at the worst possible time. So you should have a traditional map and compass with you (although the map could be printed from your computer) and know how to use them.


***Fig.1 (Left): Terrain Navigator displays the programmed waypoints in blue, with the legs between them in red. Fig.2 (above) is a somewhat less impressive but more practical view of the route plotted on the opposite page.***

In last month's article we discussed routes and waypoints. Most GPS's can store several routes, each with many waypoints. That way you can have several trips stored away, and on the day in question you can choose which trip to make depending on whether it is clear or raining, or whether you feel like a big climb or a bludge trip. When you return your computer can display a vertical "profile" of your journey to make you feel proud or guilty, depending on what choice was made.

A couple of days before your walk, you can sit down with a map and work out the best route to get to your destination. Nowadays you can do your planning on a computer screen, studying the walking tracks and contours displayed on one of the CD-ROM topographic maps.

With programs such as Terrain Navigator, you select a 'route tool', move the pointer to a waypoint site, and then click the mouse. As you move the pointer to your next waypoint site, a line from the first waypoint follows you, stretching like a rubber band. When you click to select your second waypoint, the line becomes fixed - it's now a 'leg' between the first two waypoints. When you move to select a third waypoint, a line follows you again, and it becomes fixed as another leg when you click the mouse. This way you can build up an entire route, click by click. And after it's finished you can load the route into your GPS receiver.

Waypoints should be put at places with prominent physical features — these might be noticeable changes in track direction, or perhaps creek crossings. If there is a junction between two tracks, place the waypoint slightly along the track you want to follow, instead of at the junction itself. That way the GPS will point you to the correct track.

Fig.1 is an image of the computer screen with Terrain Navigator running. A complete trip route is displayed as a fairly wide-angle view, starting on the left where you leave the cars and progressing right and then down to finish at Mount Olympus, the loftiest peak in the Olympic National Park. The waypoints are in blue, and the legs between them are in red. The actual walking track meanders alongside the Hoh river. The waypoints were chosen with reference to a trail guide book — they are places which have campsites or water.

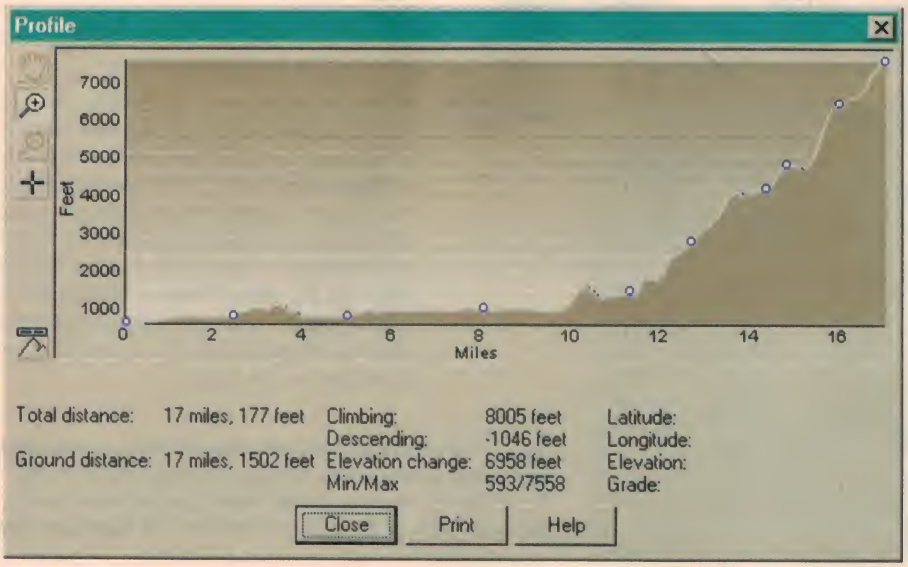

*In Fig.4 (above), the yellow line is the trip up the mountain, while light blue line is the path back down.*
***Left: On yer bike! GPS on two wheels.***

**It performed better coming down than going up - then again, the same goes for the climbers...**

This is probably a five-day trip: There's a long drive from Port Townsend to the start of the walking track. There would probably be enough daylight left to get to the waypoint called Olympus, about half-way along the river, for the first night's camp near a ranger station. The following morning you would make your way to Glacier Meadows, which is the base camp for a summit assault. On day three, before dawn, you'd go for the summit and then back to Glacier Meadows, day four back to Olympus Ranger Station, and day five, out to the cars and home.

This trip is not for the faint-hearted. Fig.2 is a 1:25,000 map of the route from Glacier Meadows to the top, across steep ridges, glaciers filled with crevasses, and sheer rock walls. I'm not going to claim I've made this trip, or that it's likely I ever will. But it is my dream. The mountain image is a computer-generated 3-D view of the area covered in Fig.2, with a similar route plotted. Looks like fun, huh?

On a Mt. Olympus trip, the GPS may or may not work reliably, depending on the vegetation along the river track and up to Glacier Meadows. But that's no big deal, since the walking track is well-marked. After Glacier




***A profile map of the climb, which apparently went to over 8000 feet. This sort of printout is great for impressing the neighbours when you get back home.***

Meadows, however, the track fizzles out and you're on your own. Not to worry, because the vegetation also disappears, and your GPS receiver has a good shot at the satellites.

## Maps or arrows?

There are two main ways to follow a GPS route. One is using the map screen, which shows your waypoints connected by legs, exactly as they looked on the map on the computer. The original map is not shown, only a plain background, with a marker showing where you are in relation to the route. Future GPS receivers will most likely show the topographic map as well.

As you move along on your walk, your position appears stationary and the map moves past you, waypoint by waypoint. If you're following a typical winding walking track, you won't coincide exactly with the displayed route legs, but you can easily see that you're going in the right direction and how far you have to go.

The second method uses the screen with the arrow and compass rose. The arrow points to your next waypoint, so you simply walk in the direction of the arrow (more or less, depending on the actual walking track route). As you pass each waypoint, the display flips along to the next one.

The arrow is more useful when you're walking a direct route, without a track, so you would switch to the arrow method for the final ascent of Mt. Olympus. The first waypoint after Glacier Meadows gets you up a ridge where it's a direct shot across Blue Glacier and up Snow Dome.

The second waypoint is the location of a shelter, and in case of bad weather, following the arrow could very well save your life. The final waypoint marks the correct summit, known as West Peak. It would be a pity to climb the wrong mountain after all that struggle!

As mentioned earlier, GPS ain't perfect, especially in thick forest on the side of a mountain. Both the forest and the bulk of the mountain itself block satellite signals, and the GPS tries valiantly to fake it the best it can. But sometimes, enough is enough.

Fig.4 is the record of an ascent of Mt. Zion, a flat-topped mountain much like Hobart's Mt. Wellington, about 1200 metres high, with glorious land and sea views from the tip. The side of Mt. Zion is very steep, so the walking track is a series of traverses and zig-zags, doubling back on itself several times.

The route legs are again in red, the waypoints are blue, and the blue line near the bottom is the car's GPS track to the carpark. I placed the waypoints at places where the walking track doubled back on itself, which probably wasn't such a good idea; because in some places, the second waypoint along from us was actually closer than the first, just higher up the mountain.

The GPS wasn't too impressed with this, and it kept trying to lock onto the nearest, instead of the next waypoint. That's when it could see the satellites at all. Many times it was blinded by trees and rock, as indicated when the GPS speed display dropped to zero.

The yellow line is our course up the mountain, as seen by the GPS. We were following the walking the track, watching the GPS display flipping wildly or freezing altogether. About half-way up the mountain, the GPS beeped madly and then delivered a terse message "Power-down and re- initialize". This was its way of saying "to hell with it". The yellow line stops at this point. We powered down, re-initialized, and kept walking, but the GPS never came to life again until it broke out of the trees a few meters from the summit, where the yellow line reappears briefly.

The purple line is our trip back down. We've had the GPS receiver up that mountain twice now, and both times it's performed better coming down than going up. Then again, the same goes for the climbers. The purple line is intact, although far from truthful about our course down the walking track. Near the bottom it staggers around in a complete circle. I swear, we were totally sober!

This journey proved that GPS is mostly useless in this kind of terrain, except at the top of the mountain. Here it gave us an accurate

*(Continued on page 91)*

## GPS on the road

So far we've been talking mostly about GPS on the hoof, but a handheld GPS is plenty useful in other ways too. It will work fine in most cars, sitting on the dashboard so the receiver's antenna can look up and out and see the satellites. But for peak performance, an external patch antenna is the way to go. After much internet digging, I wound up with a Canadian product called a Mighty Mouse.

It does indeed look like a computer mouse, but it has a cable about five metres long, of very thin coax. The Mighty Mouse has an amplifier of about 25dB gain mounted right at the antenna and powered from the Garmin GPS by DC fed up the cable. The gain is sufficient to overcome the loss in the coax, while delivering a good noise figure. The antenna has a magnetic base which you plop on top of the car, from where it grabs handfuls of satellites and delivers them to the GPS receiver, almost always with full strength on the S-meter display.

The Garmin 12XL contains a database of 20,000 cities of all sizes. When you zoom out the map display to 100km or so, as you would for highway travel, town names slide onto the map and slowly disappear behind you as you roll along. This does add a feeling of confidence in unfamiliar territory. It's also good fun to do some GPS-led bushwhacking on back-country logging roads.

If you load down your passenger seat with a laptop computer and then plug the GPS into it, you can follow your progress as a moving object displayed right on the map on the computer screen. You can even buy a stand-alone moving-map GPS. Some new luxury cars are already offering built-in GPS is an option, and one car-rental company is even talking about installing GPS, loaded with street-map data, into every car in its fleet.

I have yet to try my GPS on the water, but I'll certainly have it with me on my next trip to Seattle by ferry. As for air, many planes already have GPS as a permanent navigation aid, but passengers are getting in on the act too. Apparently you can hold a handheld GPS up to a plane's window and it will work, or better yet you can use an external patch antenna with some double- sided masking tape. The GPS then displays position, altitude, and speed, so you can send a message up to the pilot if you think he's getting lost. That would make you really popular, huh? Actually, some airline pilots are a little twitchy about passenger GPS because of radio interference worries, so it might be wise to ask before using one.


The first American to climb Mt. Everest, Jim Whittaker (who lives here in Port Townsend), had GPS with him all the way. Jim and his family are now half-way through a circumnavigation of the world in his yacht *Impossible*, although they've taken a break from it for a while. *Impossible* is laid up on a slip in Gladstone, waiting for them to resume the journey.

Jim's wife (and ship's navigator) Dianne Roberts, told me that they keep two GPS's on board, operating independently, so they can compare results. She said GPS is now so popular with yachties that collision is a growing danger, as many yachts try to sail the same legs between the same waypoints.

# Building VAF Research's Signature Series Loudspeakers

By John Matheson

South Australian – based loudspeaker manufacturer VAF Research has earned a reputation for developing what many regard as some of the world's best loudspeakers, then selling them directly to customers from their factory. Regular readers of EA will probably be aware that VAF offer a wide range of speakers, and all models are available fully assembled or as 'ready to assemble' kits. But what of the very upper end of VAF's range, as a do-it-yourself speaker construction project? Is it practical for the home constructor to put together a refined, very high-performance speaker system from a kit, and still be confident that the system will deliver the goods?

To give you an idea of how this can be done, here we'll look at the construction of VAF's flagship loudspeaker, the Signature I-93. Priced at a cool $5,821 (kit version with satin timber), the Signature I-93 is a no compromise design that represents what VAF believes is the pinnacle of performance of moving coil loudspeaker technology available today — regardless of price. The I-93 achieves a remarkable frequency response of 21Hz to 19kHz at +/- 1.2dB, combined with a phase response of +/- 5 degrees from 100Hz to 20kHz, as illustrated in the plots shown here (Plots 1 and 2). In fact, the 20Hz to 20kHz range falls inside a +/- 2dB window, so you'd be hard pressed to find an active subwoofer that goes as low as these!

Getting the kind of specifications in distortion, phase linearity, and spectral balance

achieved by the I-93s is a non-trivial exercise. During construction, extremely fine tolerances and attention to detail are needed at every stage of assembly to prevent the degradation of performance.

Naturally then, the question has to be asked; If you are buying what are reported to be amongst some of the best performing loudspeakers today, why would you bother assembling them yourself? After all, there are considerable issues at stake, not the least the embarrassment of putting a screwdriver through a very expensive cone. However, if you are adventurous and have the time, there are two very good reasons for building your own. Firstly there is a not inconsiderable saving to be made — helpful if you are stretching the finances so that you can buy the best possible set of speakers. Then there is the satisfaction of constructing your own loudspeakers, where the joy you derive from impressing your friends (and enemies) with your handiwork will be almost unlimited.

## Where to start

You can see from the cabinet drawings that building the enclosures from scratch will be more than an afternoons work. You will need plenty of room, a good saw and plunge router, as well as some bar or web clamps plus the usual selection of drills, sanders, hammers, screwdrivers etc.

In terms of pre-built enclosures, VAF supply cabinets in standard finishes including very high quality Piano Gloss Santos Palisander veneer featured in the photo's here, or two pack Satin Lacquer on crown cut, book matched Cherry, Jarrah, European Beech genuine timber veneers. Of course making the cabinets yourself from the drawings here (more detailed drawings are available from VAF) will allow you to finish them to suit your own taste, price or skill level.

VAF Research has engineered a method of assembly for each of the loudspeakers in the range that is relatively foolproof. The only thing that you miss out on by self-assembly is VAF's final performance verification. However, since every component has already undergone full testing and quality assurance, final performance verification, although reassuring, is really only a formality.

## I-93 details

The I-93 is a large floor standing 5 driver, 3-way loudspeaker. The two bass drivers are 210mm 'hard composite compressed pulp' cone devices with induction rings both in front and behind their front pole plates, plus copper plated pole plates and solid copper phase plugs. These copper components, which short circuit unwanted eddy currents, are important elements in achieving the low distortion performance of the drivers.

Two 130mm magnesium cone midranges






**The only thing that you miss out on by self-assembly is VAF's final performance verification**

are used, also with induction rings both in front and behind their front pole plates, plus copper plated pole plates and solid copper phase plugs. The Sonotex 25mm dome tweeter features a double chamber and a pure silver-wire voice coil, while silver over OFC (Oxygen Free Copper) internal wiring is used for connections between the crossover and drivers.

Mirror imaging of the bass and midrange drivers above and below the tweeters is used to create an effectively coincident acoustic source for all frequencies. Together with the drivers accurate time alignment this ensures optimum time domain performance, with excellent phase and impulse responses. Note that this often-used baffle layout does not on its own guarantee coincidence or time alignment, let alone optimum performance.

A trim piece on the baffle is used to control the transition between baffle and driver roll surrounds, controlling diffraction, as do the steps near the edge of the cabinet. Natural fibre felt pads are used to control diffraction and dispersion around the drivers as well. All of this is absolutely critical to achieving such low ripple in the frequency response of the system, and translates into a high level of detail in the final reproduced sound.

The crossover components are very large in the I-93, so as to minimise losses and unwanted energy storage in the crossovers. Inductors are wound to a 1% tolerance using 2.5 mm solid enamel coated OFC, while a the capacitors are high quality, high voltage, close tolerance metallised polypropylene types that do not deteriorate with age or use. Resistors are close tolerance, high power ceramic, non-inductive types.

Despite the number of components, the system uses all first order crossovers. Only first order crossovers can correctly sum in the time domain without further 'all pass' filter networks to correct the phase - these would add their own 'mud' to the sound. Bi- and tri-wiring options are also provided, by the way.

## Delivering the goods

If you are building your own cabinets you will need a VAF's 'Kit Without Cabinets'. This includes all the parts, foam, crossovers,

cables, fasteners and so on that you will need. These are not ordinary speakers, and even the kits without cabinets have a lot of individual parts and come in a surprisingly large package. Cabinets are constructed from first grade MDF in 5mm, 12mm, 25mm and 40mm thicknesses. You should use MDF adhesive to glue the joints rather that the usual PVA type, as normal PVA adhesives will not dry hard with MDF.

If you take the easy way out and buy a full kit (with cabinets) from VAF, the Signature I-93 loudspeakers feature high quality timber finishes. Delivering them to your door unmarked requires some very substantial packaging plus the help of one of Australia's fussiest carriers, IPEC. They are delivered suitably entombed in wooden caskets, but you should be warned that you'll need some brawn to move the packages around. (A surreptitious reason for inviting your friends, otherwise a forklift would not go astray!) You'll also need a fair bit of space for assembly — a garage-sized room will do nicely; any less and you may be cramped.

Apart from two large wooden crates, there are two large cardboard cartons, one very heavy (picture 1) and one light. These contain the loudspeaker components and a jigsaw-puzzle set of Hypersoft sound dampening foam pieces, respectively. Don't be tempted to open up all of the packages, though. There are so many pieces, you'll only end up in a mess and risk damaging something. Leave everything in its original packaging until it's needed.

The cabinets featured in this article are the high gloss 'piano finish', which adds $1,822 to the base price of $5,821 for kits including cabinets. It sounds like quite a price hike, but there are twelve hand finished coats of lacquer required to achieve this finish.

## Construction

Whether you have built your own cabinets or bought them from VAF, this is where the fun starts. To avoid scratching the finish use a blanket or two to protect the cabinets from damage during assembly. Find the instruction manual in the top of the heavy box, and settle down to a cup of coffee or two. Planning and understanding the tasks ahead is paramount to avoiding mistakes, and there's several hours of work ahead.

VAF supply clear assembly instructions, which you should be able to follow without problems. Anyone who has dabbled with loudspeakers previously should find construction straightforward, so a detailed description of each step is not repeated here. You won't need any unusual tools either, just a heavy duty soldering iron. Hopefully, the accompanying pictures should illustrate how easy the process is, but if you find that something doesn't seem right, VAF has an Australia-wide free call 1800 inquiry number for technical assistance. All in all, the assembly procedure is quite straightforward, and mistakes can be avoided by carefully reading the instructions before proceeding.

## Putting A Damper on Things

The Hypersoft foam damping material supplied is quite extraordinary stuff. It feels soft, almost oily, and yet it is extremely resilient. Bracing and damping are critical to the performance of these loudspeakers, so take the time to be sure that you fit all of the damping materials correctly. It can be a little tricky visualising how all the machine cut foam pieces fit into place. Manoeuvring felt and foam through the midrange driver holes is a bit fiddly, as you can see in picture 4. It is very important to get all of the pieces correctly positioned. Fortunately spring pressure from the foam holds everything in place.

Incidentally, if a perfect loudspeaker is one that is able to reproduce a recorded acoustic signal that sounds like the original acoustic source, then it stands to reason that the loudspeaker can not add or take anything away from the original signal. The three critical parameters in achieving this are time, energy and frequency. That is, an accurate loudspeaker must produce the right amount of energy at each frequency at the right time, no more and no less.

Loudspeakers are teeming with mass/spring/damper elements and their electrical equivalents. The response of an underdamped mass/spring/damper system to an impulse is oscillation or 'ringing', like a weight bobbing on a spring. Note that the oscillation did not exist in the exciting impulse, it is created in the mass/spring/damper system.





**Cone damage is not covered by warranty. This is probably the only part of the whole procedure to be apprehensive about**

Mass/spring/damper systems store energy, robbed from the original impulse, and release it at discreet frequencies over time.

This is where all loudspeakers have weaknesses, and incidentally why some loudspeakers give acceptable performance for one type of music but not another. If a loudspeaker's resonances (oscillations) are musically sympathetic to the type music being played, they will 'enhance' the sound. It won't be accurate, but it *may* be musical!

The most common representation of a speaker's time, energy, frequency response is the cumulative decay spectra or 'waterfall' as depicted in Plot 4, which in a two dimensional representation on a page, shows energy from bottom to top, frequency from left to right and time towards you. Without energy storage, the cumulative decay spectra of a loudspeaker would not look like a waterfall at all; it would look like a sheer, straight cliff face.

Once the loudspeakers are fully assembled, you will notice just how little resonant sound there is when tapping one's knuckles on the sides of the I-93's cabinet. Any resonances would spoil the transient and time response of the system, which in turn would blur the infinitesimally small details and compromise the VAF's clear imaging. The impedance curve, depicted in Plot 3, also indicates how well behaved the I-93's are — no reasonable amplifier will find these loudspeakers a difficult load to drive.

## Driving Forces

A lot of development has also gone into refining the drivers. They are high quality Seas Excel units (picture 2) but have been modified to VAF's specifications.

Lacquered copper phase plugs protrude from the bass and midrange drivers. These sit in front of the front copper shorting ring in the pole, and are used to eliminate inductance modulation and promote low distortion performance. There is another copper shorting ring inside at the rear of the pole, and the external flux plates are copper plated to short out surface eddy currents, as well.

The driver cones are treated in each case to reduce energy storage (see Picture 3), while the midrange unit uses a solid magnesium cone. This is made from cast magnesium which is over 98% pure, and the cone is then machined to its paper-thin final profile.

## Crossovers

You may be surprised to see that the crossovers are hard wired component to component, rather than on a printed circuit board (see pictures 6 and 7). The reasoning here is that handmade crossovers like these are more reliable and easier to optimise than a circuit board construction. The interaction of energy fields around individual components can not be disregarded at this level of performance, and it is a lot easier to optimise if construction is not constrained by the fixed layout of a circuit board.


The crossover is pre-assembled with the terminal panel, saving a large amount of time and effort on the constructor's part, as well as reducing the risk of incorrect wiring. Remember to seal the holes through which the midrange and tweeter wires pass through into the mid enclosure (picture 9). It's easier to do without the bass drivers in the way.

Also mounted on the crossover panel is the reflex port, which has dimensions and flaring that eliminate turbulence. These loudspeakers will need to be positioned at least 300mm away from walls to avoid acoustic reactance affecting the port tuning.

## Putting It All Together

Before fitting all components, gasket tape must be applied to provide an airtight seal. VAF supply a high quality closed cell foam adhesive backed tape with mastic properties. Not only is it great stuff, it's easy to apply and form into curves as well, as can been seen in picture 11.

Wiring and installing the drivers should not present any problems. Each wire is labelled and the drivers have (+) and (-) marked. Gold plated terminals aid soldering. To do this properly, you'll need a large iron with a 5-6mm chisel tip, since considerable heat is required because of the large conductor size. The trick is to have enough heat energy stored in the iron tip to complete the soldering quickly so as not to melt the drivers' own terminations (see picture 12).

Once all of the components are soldered in place, it would pay to get someone else to carefully check that each termination is correct and properly soldered. If there is an error, it is going to be a damn nuisance (but not impossible) to rectify later. Just relax for a moment, go away for another coffee and let your best mate or partner check it all over. Remember, striped wire = positive = red = (+).




After fitting all the damping and seals, the crossover panel and drivers can be screwed down, using the various different fixings supplied. Before finally tightening the crossover panel, check for squareness. Because of the crossovers sheer weight a tap with a mallet may be needed to get it spot on, but use a block and a cloth to protect the finish.

Make sure to use the correct length screws for the drivers, and be careful not to force the screws because you may dislodge the 'T' nuts into which they engage. However you choose to screw down the drivers, take great care! Cone damage is not covered by warranty. This is probably the only part of the whole procedure to be apprehensive about. If you use a power driver, make sure to set the torque limit to a low setting at first and sneak up the bolts, like you are doing up car wheel nuts or cylinder head bolts.

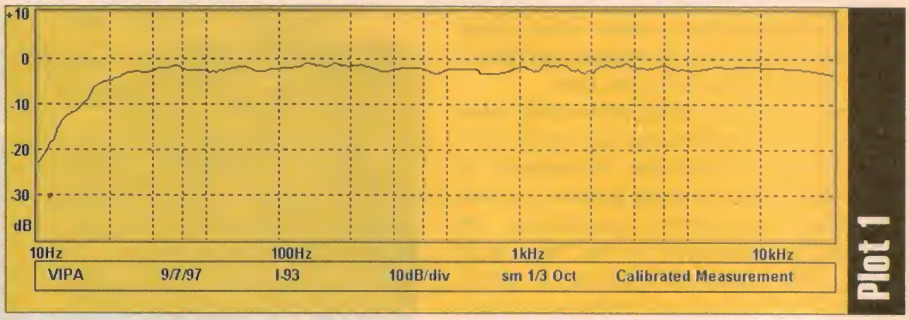
VAF fit a dress panel to the front of the baffle, which has a dual purpose. It serves to hide the screw heads (and any marks caused by misplaced objects during assembly) and to remove any diffracting edges around the drivers, critical for ripple-free response. Because the bass drivers effectively locate this panel, a trial fitting before attaching the adhesive tape is a good idea. If it doesn't line up exactly, loosen off the one or both bass drivers and nudge them until the trim is square. Don't forget to tighten them again before fitting the trim panel as shown in picture 14.

After attaching the trim panel with several layers of gum tape, felt cut-outs are fitted around the midrange and tweeter units (picture 13) to eliminate diffraction and control acoustic loading. These are pre-cut and glued in place with the supplied tube of 'Tarzan's Grip'.

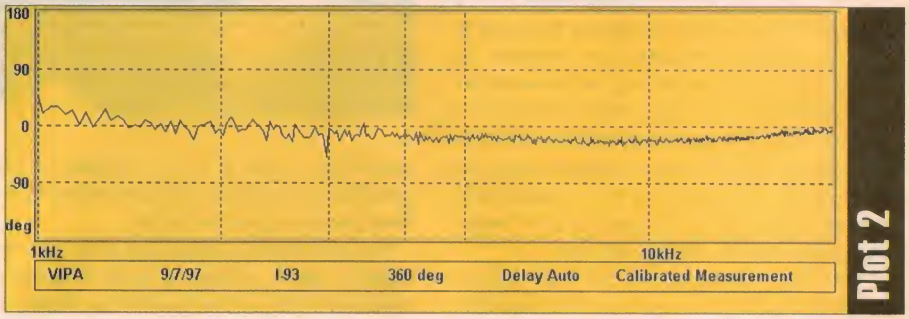
## Decorative Grilles

VAF use an elegant method of attaching the grille cloth to a frame, similar to fitting flywire to a screen, where a spline is rolled into a rebate. The beauty of this method is that the cloth is not damaged by the attachment; if you are not happy with the fit as you go along you can pull the spline out and start again. Follow the instructions supplied, pull the cloth reasonably tight, and you should be able to get it right first time.

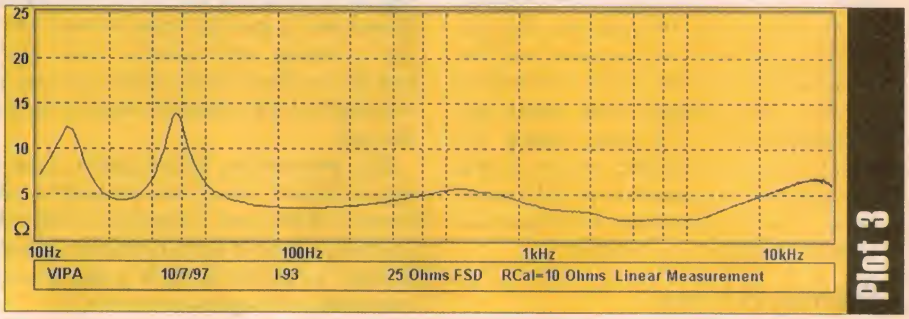
The grilles really are decorative too. It's not intended that they be in place for serious listening sessions. Needless to say, the differences are small, but noticeable if you want to be really critical. It's suggested to leave them on as a matter of course to discourage pets and little children poking around. Savour the loudspeakers' naked appearance whilst you listen to your favourite music.



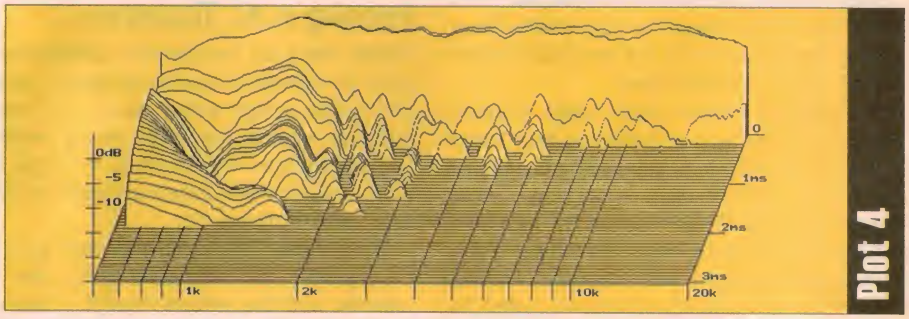
Plot 1



Plot 2



Plot 3



Plot 4

| SPECIFICATIONS | |
|---|---|
| FREQUENCY RESPONSE | 17Hz-21kHz |
| | 21Hz-19khz +/-1.2dB |
| PHASE RESPONSE | +/- 5 degrees (100Hz to 20kHz) |
| SENSITIVITY | 89dB/W@1m |
| NOMINAL IMPEDANCE | 3 ohms |
| AMPLIFIER POWER | 10-500 Watts RMS |
| DIMENSIONS | 1575(H) x 270(W) x 491(D) |
| WEIGHT | 200kg per pair |
| **PRICES** | |
| KIT ONLY, NO CABINETS | $4,042 |
| KIT WITH CABINETS (SATIN FINISH) | $5,821 |
| KIT WITH CABINETS (PIANO GLOSS) | $7,643 |
| ADDITIONAL COST FOR ASSEMBLY | $900 |
| FREIGHT WITHIN AUSTRALIA | $129 |

*Right: The author fitting the I-93's inset dress panel, during the final assembly stage.*

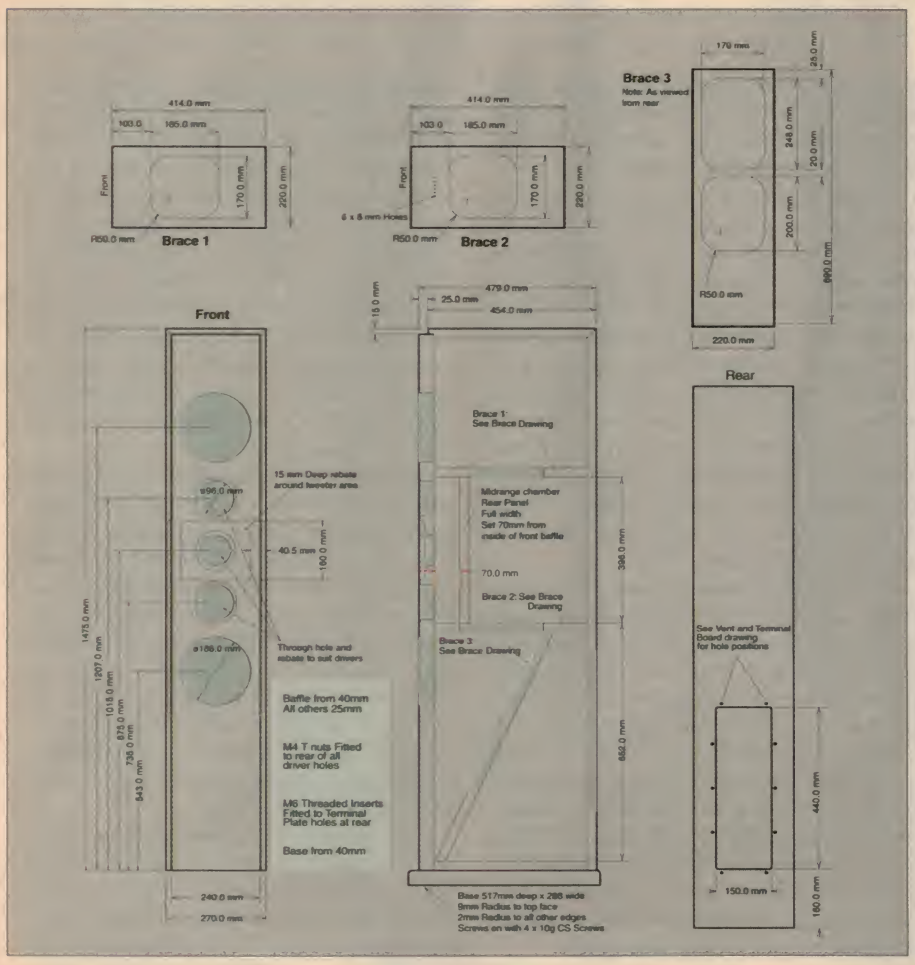
## Listening Experience

The VAF owner's manual provides some detailed information on how to set up your listening room and where to place the speakers for best results. If you follow this advice, you shouldn't go too far wrong.

So do the Signature I-93's have an Achilles Heel? Well they are big, and expensive, but not as big and/or expensive as anything else that offers similar performance. These particular timber cabinets may not be to everyone's taste, but since VAF will custom manufacture (for a negotiated increase in cost) any cabinet finish imaginable, that is not really an issue.

VAF Research is fortunate enough to have access to some very exclusive high-end home theatre equipment as a test bed. In their showroom, the I-93's are joined by an I-91 centre and I-66 rear's driven by an Enlightened Audio Designs TheatreMaster Ovation surround sound processor and preamplifier and PowerMaster 2000 five channel 2,000 watt amplifier, a real dream home theatre system. What a revelation it is to hear a spectrally matched properly balanced surround system - just fantastic! This is the future of home hi fi and it's here now!

All production information, pricing and many magazine reviews are available on VAF Research's web site at **http://www.vaf.com.au** or by ringing their FreeCall number 1800 818882. If you are in Adelaide, the entire VAF range can be auditioned at VAF's new headquarters at 52-54 North Terrace, Kent Town, just two minutes from the city centre. ❖



# Pioneer DV-626D

## DVD & CD Player



***The latest addition to Pioneer's range of DVD players offers some impressive 'up market' features such as a built-in decoder for both Dolby Digital and DTS 5.1-channel digital surround sound, component video outputs as well as S-video and composite video, and variable speed play. Together with extras like SRS TruSurround virtual surround and the ability to play CD-R discs, they give it a lot of appeal.***

*by Jim Rowe*

LUCKILY FOR THOSE consumers who haven't as yet splurged on a DVD player, the technology continues to gallop ahead. Players are slowly dropping in price, and/or acquiring nice new features — or features previously found only on top of the range models. It's all changing in the right direction, especially as a lot more DVD movie titles are being released as well. At last!

Pioneer's new DV-626D is a good example of the trend. It's in the upper-middle price range, to be sure ($1499 RRP), but it comes complete with just about all the features that most users are likely to want. In fact it's really only a matter of months since this kind of combination of features was only found in the *really* high-end players, costing well over $2000.

Perhaps the most impressive feature is a built-in digital surround sound decoder, able to deliver a full 5.1 channels of audio from *both* Dolby Digital and DTS (Digital Theater System) tracks. Not that there are any Region-4 DVDs with DTS tracks at this stage, but they'll probably turn up soon — there are currently about a dozen titles available in Region 1.

At present the vast majority of DVDs released in our region have Dolby Digital tracks of one type or another, so the main thing is that DV-626D owners will be able to achieve the full surround sound potential of these discs simply by hooking up the player's six audio outputs to a suitable complement of amplifiers and speakers. And when titles with DTS tracks *are* released, they'll be able to play them properly too, without having to invest in further decoders. Very nice!

Another impressive feature is the provision of component video (Y/Pb/Pr) outputs, as well as the usual S-video and composite video outputs. This means that those with the latest TV sets and projectors, fitted with component video inputs, will be able to achieve the absolute maximum picture quality that DVDs can provide (which is very impressive indeed). That's because the picture information is actually encoded on a DVD as these components (in compressed digital form), so they represent the 'purest' version of the replayed video — with minimum processing and interaction between them.

It's true that not many buyers are likely to be in a position to take advantage of this feature as yet. But the fact that the player provides these outputs means that when they *do* upgrade to a set with component video inputs, they can reap the benefits straight away.

Another nice feature of the DV-626D is that it has a dual-wavelength laser pickup, so it can play virtually all kinds of CD-R discs as well as normally pressed DVDs, audio CDs and Video CDs. This might sound like something *all* DVD players should do, but it's surprising how many still don't. In fact most simply refuse to recognise any kind of CD-R disc at all...

What other goodies does it provide? Well, there's a built-in 'virtual surround' re-encoder, to allow those with only a two-channel stereo sound system (or stereo TV) to achieve reasonably satisfying *synthetic* surround sound. It does this by first decoding the digital surround signals from the disc, and then re-combining them according to a 'secret recipe', with various phase shifts and time delays, to produce what seems like a 'surround' sound field from your two-channel speakers. In this case you even get a choice of two virtual sound encoding algorithms: either TruSurround from SRS Labs, or Virtual Dolby Digital.

Quite apart from the surround sound facilities, the DV-626D also offers adjustable audio dynamic range compression (DRC). What this does is reduce the very wide dynamic volume range of typical DVD sound tracks, so that when you turn up the volume to hear the voices easily in quiet passages, the 'loud bits' don't become deafening. There are three selectable levels of DRC, as well as an Off position where it's disabled.

By the way DRC might sound a bit esoteric, but it's in fact a very practical feature, especially for late-night viewing.

I should perhaps mention that the player uses an audio D/A converter with the ability to give 24-bit resolution at sampling rates of up to 96kHz. So it should be capable of giving excellent audio reproduction from 24-

bit/96kHz DVD tracks when they're available. (Although according to the manual, it's not capable of playing DVD-Audio discs.) It can also convert a 96kHz PCM bitstream to 48kHz, for output via the digital outputs.

On the picture side, the DV-626D provides a neat digital noise reduction (DNR) feature, which allows you to achieve cleaner pictures by applying what is effectively digital filtering to the luminance component. This is adjustable over an 8-step range, and in fact the player allows you to have the same degree of control over other key picture parameters as well: sharpness, detail, gamma and chroma delay.

If these last terms are unfamiliar, *gamma* refers to the shape of the luminance transfer characteristic, which effectively controls the black level and contrast range — allowing you to achieve the best pictures whether you're using a CRT set, a projector or a plasma panel. *Chroma delay* adjusts the timing between the luminance (detail) and colour components of the picture, allowing you to optimise colour reproduction.

Importantly, the DV-626D has three inbuilt setting memories, so you can save three different combinations of these picture parameters, and recall any of them quickly when desired. This means the player can give optimum results with say a projector one night, but also give equally good results if you need to use it with a CRT set the next night.

A feature that's perhaps a little more limited in appeal is the ability to play a DVD at a wide range of rates, in either direction. It can be set to play at 1/16, 1/8, 1/4, 1/2 or normal rate, plus three even faster 'scan' rates called SCAN 1, SCAN 2 and SCAN 3. You don't get sound in any of these slow or fast viewing modes (including 1/1), in either direction, but they're useful for studying motion or finding a particular spot.

Needless to say you also have a range of search modes, where you can jump to a particular title, chapter/track or timecode location on the disc. This is quite apart from whatever menu and scene selection facilities a disc may be provided with.

Other nice features on the DV-626D include 10-bit video processing, Pioneer's Viter-Bi RF decoding for improved error correction on DVD replay, automatic gain level adjustment for minimisation of jitter, four-level dimming for the fluoro display and an on-screen display of the digital bit rate during DVD replay (for those techies who like to know how hard the player is having to work, to decode it all).

Physically the DV-626D comes in a light but reasonably strong steel case with moulded plastic front panel, with an attractive 'champagne' coloured metallic finish.

## Trying it out

First up I ran the instruments over the player in audio CD mode, as this generally gives a good guide to the overall performance of a DVD player. The results were quite encouraging, too.

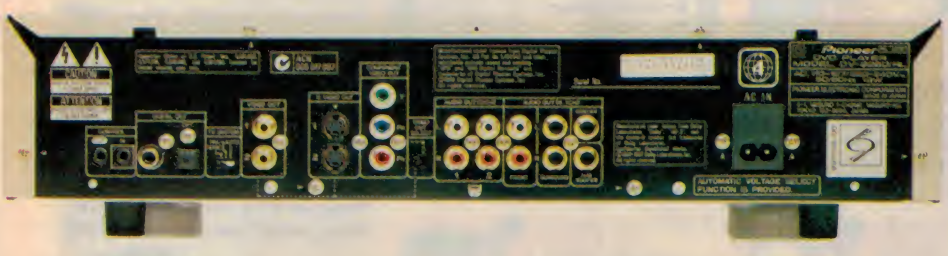
The frequency response turned out to be very smooth, and within +0dB/-0.6dB between 20Hz and 20kHz, with the channel balance better than +/-0.15dB. In fact the response was only 0.12dB down at 20Hz (the lowest frequency on my test CDs), suggesting that the response extends smoothly well below that point.

The fade to noise performance showed very linear operation down to beyond -75dB, but with noise gradually coming in at lower levels. The lowest output level I could measure was -99dB, for the 'digital silence' track. This is quite respectable, of course, but not in the same league as top-end players.

The square-wave response showed a moderate level of symmetrical ringing, of about 7% peak amplitude. Similarly the impulse response had ringing of about 19% peak. This shows 'above average' filter performance, but certainly not as good as players like the Denon DVD-5000 I reviewed a couple of months ago.

After these tests I spent some time listening to some of my reference CDs with the DV-626D, and also sampled a few CD-R discs I've made. My subjective impression was that the player does an excellent job with both types of CD; certainly better than most existing CD players. The treble is clean, the stereo image is well defined and overall balance is fine.

Then I used the player to watch a couple of DVD movies — one using a Panasonic PT-L557EA LCD projector, and the other on my Sony 68cm Trinitron set. In both cases I spent a bit of time setting up the surround sound



*As you can see, the rear provides just above every kind of output you could wish, for both video and audio.*


*The remote's Enter/joystick button is just a tad fiddly to use...*

amps and speakers to achieve optimum balance, and also carefully set up the DV-626D's video parameters to suit the display.

By the way it was when I was trying to do the surround sound setup that I discovered the only real functional shortcoming of the DV-626D: there's no built-in test signal to help you set the gain levels for the various channels. This is a bit disappointing, and seems quite an oversight in view of the fact that one of the player's main features is its built-in surround decoder. Most other players with a built-in decoder seem to provide the test signal, and it's very handy. In this case I had to use the pink noise tracks on the Video Essentials Test DVD.

Once I did have everything set up properly, though, the results were very impressive. Both the picture and Dolby Digital 5.1 sound were of a very high standard from the movies concerned, so the Pioneer DV-626D is clearly capable of excellent performance as a DVD movie player. When Region 4 discs with DTS tracks become available, I'd expect it to give similarly good results with them too. ❖

### Pioneer DV-626D

A new DVD and CD player with features including built-in Dolby Digital and DTS decoding, and CD-R compatibility.

**Good Points**: Provides component video outputs as well as S-video and composite video; inbuilt Dolby Digital/DTS surround decoding; programmable gamma and colour delay, to allow optimising picture quality with various displays.

**Weak Points**: No built-in audio test signal for surround sound setup; audio noise and filter performance could be better.

**RRP**: $1499

**Available**: Pioneer AV dealers. For more information contact Pioneer on 1800 338 439.

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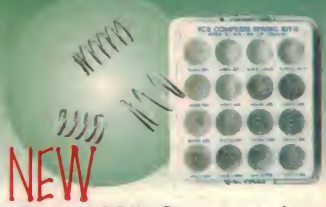


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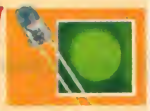

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351

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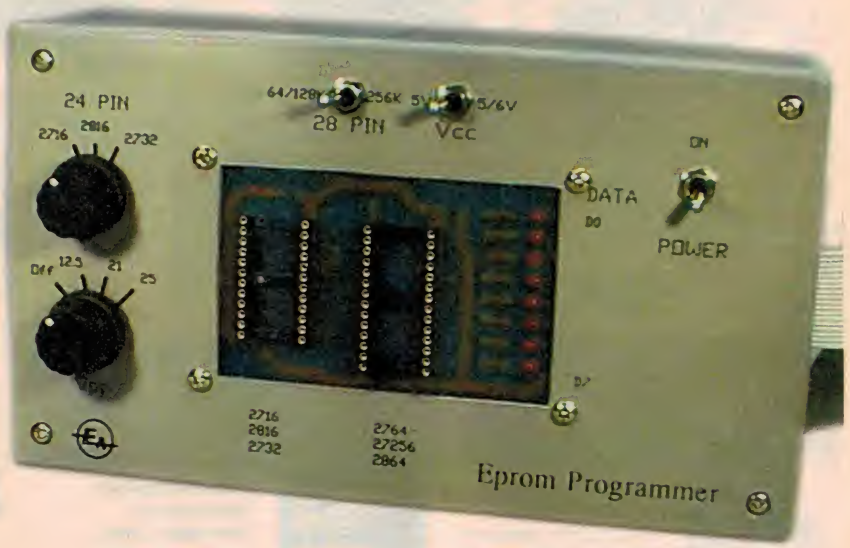
# Program BIG EPROMs!

***With one megabyte EPROMs now readily available, a compatible programmer is a must for those who want to capitalise on the 'wide open spaces' offered by these much larger devices. As it turns out, the EA EPROM programmer described way back in 1993 is reasonably easy to adapt — here, the author gives you all information needed to modify that venerable programmer.***

*by Glenn Pure*




Back in 1993, I designed an EPROM programmer for Electronics Australia, and the design was published in the September and October 1993 issues. The project remains popular today and kits are still available from Dick Smith Electronics (DSE), Altronics and probably others. I also still get a steady stream of inquiries about the project, and for the software I wrote for it.

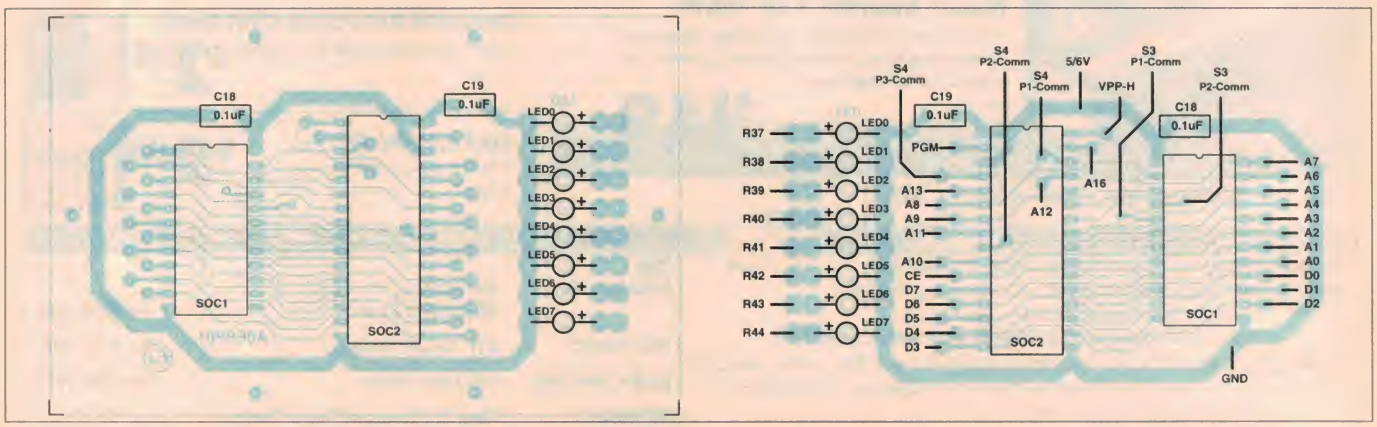
Recently DSE approached me about modifying the programmer so that larger EPROMs could be programmed, specifically one megabit EPROMs (271001, 27C1001). As a means of encouragement, DSE kindly provided a couple of sample 27C1001 EPROMs (SGS-Thomson), plus a few parts to help me when making the necessary modifications. Here are the results...

The original programmer design was only intended to take 24 pin and 28 pin devices. The 271001 EPROM comes in a 32 pin package which, unfortunately, meant that I had to do a complete redesign of the unit's second (front panel) PCB which takes the EPROMs being programmed. I also had to include an extra rotary switch, and redesign the front panel artwork. So for those who have already built the programmer, the modification will involve a reasonable amount of work. The pay-off is that I have also included a modification for 27512 EPROMs in the new design — which means the programmer can now do the full range from 2716 to 271001 EPROMs.

Note that it would also be possible to do a further modification for 27020 EPROMs (that is, 2 megabit) but I have not included this. For those who want to do so, it simply involves adding a switch to enable pin 30 on 'SOC2' to be switched between either Vcc or A17 (address 17). The 27020 requires A17 on pin 30.

The new circuit diagram for the programmer is shown in Fig.1. The main changes from the original design are:

- Switch 4 (S4) in the original design was a single pole double-throw switch. It has been replaced by a new 3 pole x 4 position rotary switch (also labeled S4). The new S4 is shown in the bottom right of Figure 1. The purpose of this switch is to change the connections on pins 3, 24 and 29 on SOC2 as required for EPROMs from 2764 to 271001.




*The component overlay diagram (left) for the new front PCB, looking from the component side of the board. The LEDs poke though the board with the legs on the copper side. Fig.2 (Right): The board from the copper side, showing all of the connection points for the wires that pass to the main board.*

- Connections need to be made to the address lines A15 and A16 on the main board. Luckily I made provision for this in the original design, and the original overlay for the main board provides suitable connection points right up to A18.
- As already noted, a new 32 pin socket to take the larger EPROMs had to be incorporated. This resulted in renumbering of the pins on SOC2 and changes to the pin connections.

All the changes from the original design are shown in (red) in Fig.1. The new second PCB and the overlay are shown in Fig.2. Note that this diagram is the view from the copper (underside) of the board to assist when soldering up the connections to this board. The connections to the new S4 are also shown on the overlay in Figure 2 (marked as **S4 P1-Comm**, **S4 P2-Comm** and **S4 P3-Comm**). The same designations are shown in brackets on the terminals of S4 in the schematic (Fig.1).

For those building a new programmer, the revised design is assembled according to the original instructions except for the change to S4 and the changed second board. Connections between the main programmer PCB and the revised second board are achieved by simply follow the second board overlay in Fig.2 (eg: D0 on the main board connects to D0 on the second board, A6 on the main board connects to A6 on the second board and so on).

For those retrofitting the modification to the original programmer, you will obviously need to completely unsolder the original second board, scavenge what bits and pieces you can from this (ZIF sockets, LEDs etc) and then replace it with the new second board. Note that I have tried to improve the location of pads for soldering connections to the main board and switches.

When deciding how you will be plugging your target EPROMs into the second board for programming, a couple of options are worth considering. The cheapest option is to use IC sockets. I have found that the inexpensive dual-wipe sockets are actually better than the more expensive machined pin type, as it is easier to insert the EPROMs in the former. Note that 32 pin sockets are not, however, easy to come by. Fortunately, there is a simple solution. Take a 40-pin socket and cut the last 4 pairs of pins off the bottom with a hacksaw or other suitable tool. That's what I did! For a more fancy connection method, use zero insertion force (ZIF) sockets. These are fairly expensive so don't bother unless you plan to make quite a lot of use of your programmer.

A final word on using the programmer. SOC2 is now a 32-pin socket. However, EPROMs from 2764 to 27512 are only 28 pins in size. You need to be careful that the 28 pin devices are pushed into the right pins of the 32-pin socket. The new artwork for the front panel of the programmer shows what to do. Devices with 28 pins should be aligned to the bottom of the 32 pin socket (such that pin 1 of the 28 pin device connects to pin 3 of the 32 pin socket).

The modified programmer will still function with the current software, by the way. This is available from my web page at **http://www.pcug.org.au/~glennpur/electron.htm.**❖

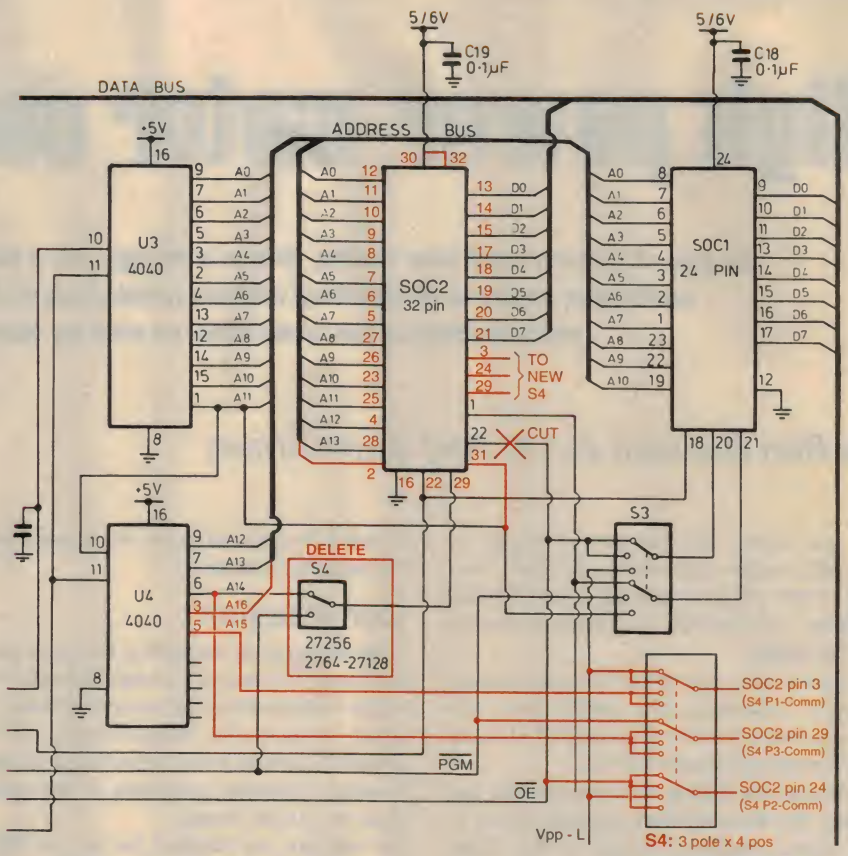
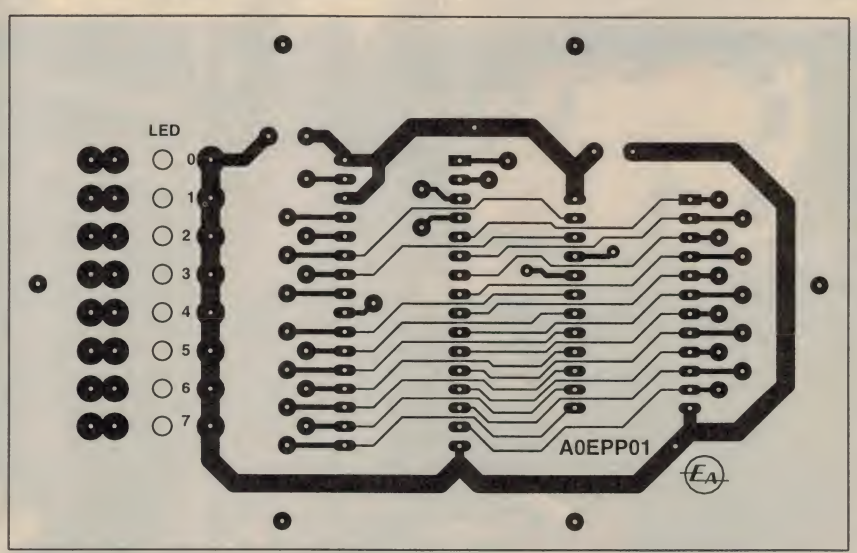



*Fig.1 (above): The relevant section of the original programmer circuit, with all of the changes that need to be made shown in red. Below is the PCB pattern shown at actual size. The new front panel artwork (in Auto/Easytrax format) can be downloaded from the EA website.*



# High power motor controller — 2

***As you may have read last month, this is a design for a compact and efficient DC motor speed controller, capable of handling motors running up to 750A at 50V. This month we cover the construction of the controller, as well as the wiring, adjustment and final testing.***

*By Ron Badman ZL1AI, and Brent Brown*

Last month we covered the design of this heavy duty motor controller, and in this second installment we'll go into the construction and implementation of the design.

There's just one thing to note though: despite describing this project over two issues, there is still a large amount of material that we just couldn't fit in.

Instead, the drilling and dimensioning diagrams for the aluminium busbars (used in the power modules), images of the PCBs, descriptions of the various software routines, as well as the microcontroller source code itself have all been zipped up and made available on the EA website. If you are interested in downloading it, the file is called 750MOTOR.ZIP, and you'll find it in the Project Software area of our site at **www.electronicsaustralia.com.au**.

## Construction

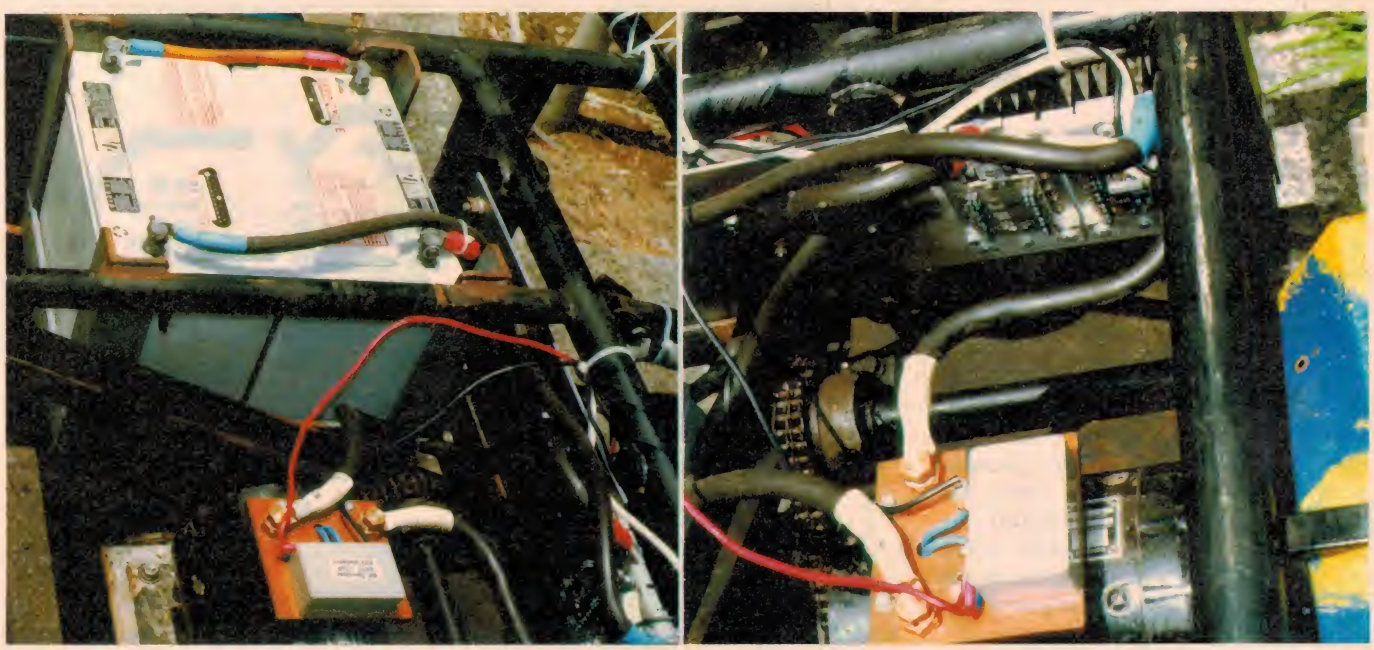
Start assembly by populating the main control board. This is pretty straightforward, with all the components mounted on the board as shown in Fig.4. The microcontroller, IC1 is socketed, so that it may be removed for any software upgrading; socketing of the other chips is optional though.

The mosfets are mounted flat on the PCB, using small individual U shaped heat sinks. The only things to look out for are the five wire links under the socket for IC1, and that resistors R18 and R19 are mounted vertically on the board. The top leads of these two resistors are joined together, and a wire run from the junction down to the nearby pad labeled R (At the junction of D1 and C6). The DIP switch SW1-4 proved unnecessary and may be omitted.

## Power module

The power module switches the current to the motor according to the PWM signal from the main board. It is made up of ten power mosfets connected in parallel and mounted on an aluminium frame, with a driver circuit board on top.

The aluminum frame provides a low resistance, high current electrical connection for the drain and source terminals of the mosfets, and also gives good thermal conductivity for transferring heat between the mosfets and the heatsink.



*Heavy duty cabling heading off to the deep-cycle battery and motor. Note the snubber network on the motor, and the diode/power module above it in the right hand photo.*

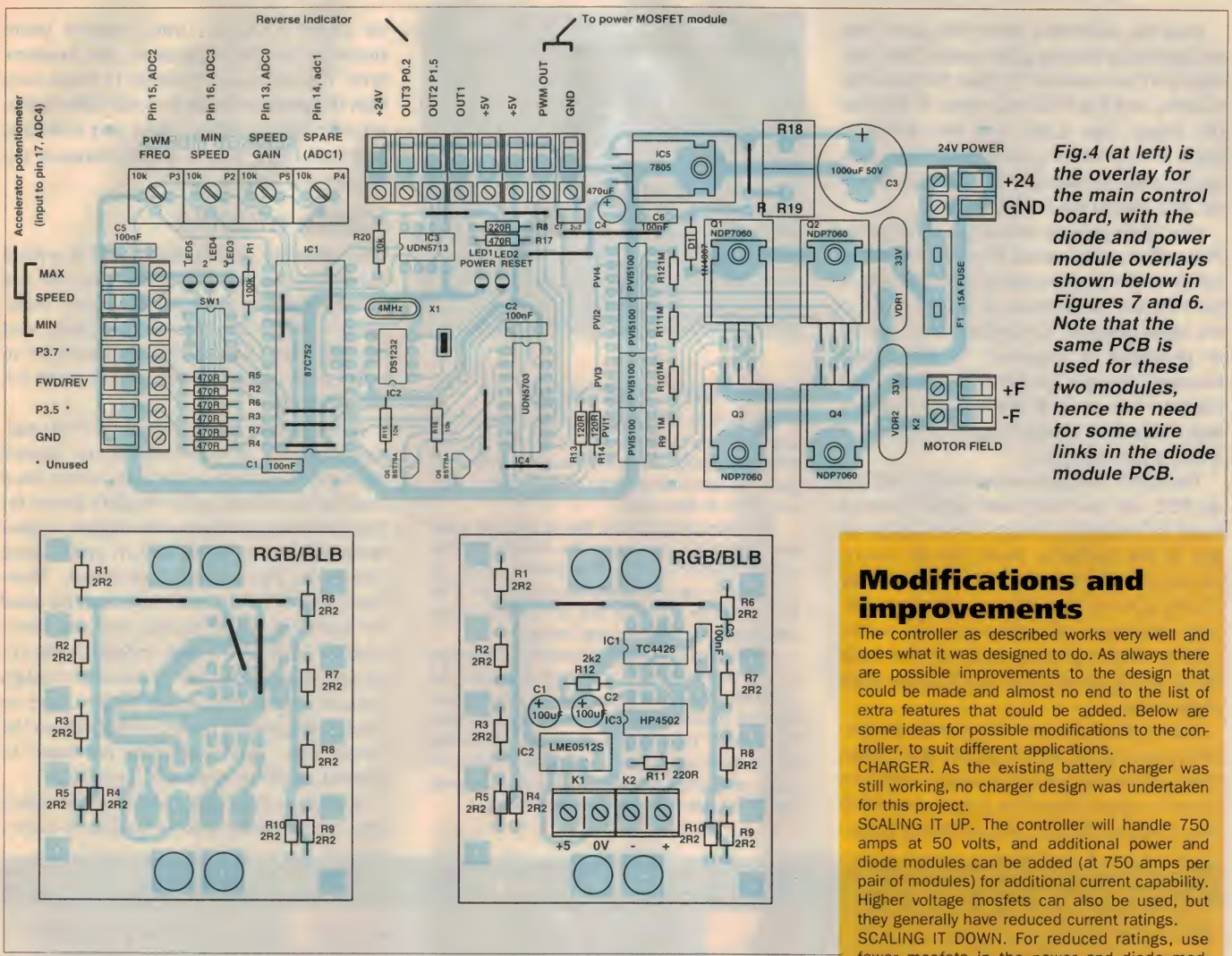



*Fig.4 (at left) is the overlay for the main control board, with the diode and power module overlays shown below in Figures 7 and 6. Note that the same PCB is used for these two modules, hence the need for some wire links in the diode module PCB.*

To assemble the power module, first screw together the two source busbars and the two cross bars to make a frame. Then fix some insulating cardboard underneath the two source busbars using double sided adhesive tape or contact adhesive. Leave the cardboard insulation 20mm short for clearance at the termination end of the busbar, and drill holes in the insulation where the mounting screws will pass through.

In the same way, fix pieces of insulation underneath the cross bars that connect the two source busbars, to insulate them from the drain busbar. Position the assembled frame over the drain busbar and use clamps to temporarily hold it in place. There should be a neat parallel 2mm gap on each side of the drain busbar, insulating it from the two source busbars. Fig.5 should explain everything.

Next prepare the ten mosfets for mounting. To do this, cut off the centre lead of each device, as the metal tab will be used for the drain connection instead. Crimp and solder a brass terminal lug to the source lead, at a length that suits the hole positions for mounting the mosfet to the frame. The mosfets can now be screwed down to the drain and source busbars.

Use a small amount of heatsink paste under the tabs of the mosfets but no insulating washers as this screw provides a vital electrical connection. Do not screw down the tabs on the two mosfets at each end just yet, as these will have to have a spacer and longer screw for supporting the driver PCB. Bend each gate lead of the mosfets up at 90 degrees to line up with holes in the driver PCB.

The driver PCB is double sided, but the top layer is purely a ground plane, as a precaution against feedback and possible oscillation. Install all the components on the driver board according to Fig.6. Do not forget the important 'via', just to the left of R7, that connects the circuit ground through to the ground plane. This consists of a short piece of wire through the hole, soldered on both sides of the PC board. Sockets are not used on the ICs. The ferrite suppression beads help prevent feedback and oscillation; they go over the resistor leads and hold the resistors up off the PCB like tiny stand off insulators.

## Modifications and improvements

The controller as described works very well and does what it was designed to do. As always there are possible improvements to the design that could be made and almost no end to the list of extra features that could be added. Below are some ideas for possible modifications to the controller, to suit different applications.

CHARGER. As the existing battery charger was still working, no charger design was undertaken for this project.

SCALING IT UP. The controller will handle 750 amps at 50 volts, and additional power and diode modules can be added (at 750 amps per pair of modules) for additional current capability. Higher voltage mosfets can also be used, but they generally have reduced current ratings.

SCALING IT DOWN. For reduced ratings, use fewer mosfets in the power and diode modules. Leave everything else the same.

REGENERATIVE BRAKING. Not provided as the additional complexity and cost were not considered to be warranted. However, if you want to try it, you are more than half way there. By turning the diode module into a power module (i.e., by adding the missing components) and driving it from one of the spare outputs, you can obtain what is known as two quadrant (regenerative) operation. [Reference 1] You will of course have to work out the necessary software changes for yourself.

IMPROVED EFFICIENCY. As shown in the worked example for power dissipation there is considerable loss in the mosfet used passively as a freewheeling diode because of its forward voltage drop. There is potential to turn the diode module into a power module and switch it on at the appropriate times to act as a freewheeling diode with much lower voltage drop.

EXTRAS. For the intrepid experimenter out there, there is a spare trimpot read by an A/D input, there are six spare digital inputs to the microcontroller, two of which appear on the screw terminals, and four of which are connected to the spare DIP switch SW1-4, and there are two spare digital outputs. You will of course have to get into the software to use all these spare facilities.

FEEDBACK. The authors would love to hear from constructors, and may be contacted by email as follows:

ron.badman@xtra.co.nz and
brent.brown@clear.net.nz

Drop the completed driver PCB down over the previously bent-up gate leads of the mosfets, with four spacers in place between the mosfets and the PCB, and screw it down to the frame. Now solder and trim the gate leads without bending them over. This way it will be easier to desolder and remove the driver PCB should the need ever arise.

Next fit the ground connection to the driver PCB, which is two pieces of copper shim that solder to the ground plane on the top side of the PCB and screw down to tapped holes in the lower crossbar. (See photo) This method of grounding is important to the design because it gives a low inductance path. A flying lead was used at first but its relatively high inductance caused problems when the mosfets were switched.

The frame, complete with mosfets and driver PCB, will now hold itself together and is ready for mounting through a mounting panel and to the heatsink. Insert the six plastic transistor insulating bushes in the module mounting holes from the top. From the bottom side insert insulating bushes, plastic tube, or even a piece of heatshrink to keep the mounting screws from touching the sides of the holes.

Cut a piece of thermally conductive silicon rubber sheet 105 x 80mm and punch holes for the six mounting screws. With the sheet in place screw the power module to the heatsink through the mounting panel, as shown in Fig.5 . Use heatsink paste between the mounting panel and heatsink only. Test with an ohmmeter to make sure that the power module is completely isolated from the mounting panel and heatsink, and that there are no shorts between the source and drain busbars.

## Acknowledgements

We would like to acknowledge the help of Kevin Sweeney, Electrical Engineering Tutor, without whose enthusiasm and effort the "Mebea" electric vehicle would never have existed.

Dr David Rawlence, CEO Waikato Polytechnic, Hamilton, New Zealand, for permission to publish this article.

References:

1. Philips "Power Semiconductor Applications"

## Current ratings

It is important to realise that electric motor ratings, be they in amps, kW, or HP are the continuous ratings of the motors, and these can generally be exceeded for short periods, without harm to the motor.

Be aware that a motor that is rated at 100A could hit 500A if you open the throttle with the wheels stuck in a curb, or the handbrake on. So if you don't want an expensive meltdown of all your nice new mosfets, the controller must be designed to handle the stall current.

Even if you use a fuse or breaker which trips in the event of such a current overload, the controller will still have to handle the stall current for a brief time, and semiconductor junctions don't take long to melt. An alternative would be to use current limiting or current foldback protection circuitry, but that would add greatly to the complexity of the project.

## Diode module

Each time the mosfets switch off in a PWM controller, the diodes must carry the full current that was flowing in the motor inductance (up to 750 amps in this case), and these diodes must be high speed diodes to avoid high voltage spikes which could kill the mosfets.

A catalogue search showed that high speed diodes with the ratings we wanted were extraordinarily expensive, so we used another ten of the same mosfets purely for their inherent drain-source diodes. These diodes have the same current and voltage ratings as the mosfets themselves. Thus, the same PCB and metalwork can be used for both the power module and the diode module. Because these mosfets are not driven, the gates are grounded through resistors (with suppressor beads), and no other components need be installed on the driver PCB. Four wire links are used to ground all these resistors. See Fig.7.

Assemble the diode module in the same way as the power module described above.

## Parts list

### Main board

#### Resistors

(All 1/4 watt unless stated)

| | |
|---|---|
| R1 | 100k |
| R2 - R7, R17 | 470 ohms |
| R8 | 220 ohms |
| R9 - R12 | 1M |
| R13, R14 | 120 ohms |
| R15, R16, R20 | 10K |
| R18 | 82 ohms 5 watt |
| R19 | 120 ohms 5 watt |
| RV1 | 1k slider pot (two 2.2k pots in parallel) |
| RV2 - RV5 | 10k trimpot |

#### Capacitors

| | |
|---|---|
| C1, C2, C5 | 100nF |
| C3 | 1000uF 50V |
| C4 | 470uF |

#### Semiconductors

| | |
|---|---|
| Q1 - Q4 | NDP7050 or NDP7060 power mosfets (see text) |
| Q5, Q6 | BST70A power mosfets |
| IC1 | Programmed 87C752 uP (See Note 1) |
| IC2 | DS1232 Watchdog timer IC |
| IC5 | 7805 +5V voltage regulator |
| PVI1 - PVI4 | PVI5100 photovoltaic optocoupler |
| IC3 | UDN5713 buffer IC (o/c) (See Note 2) |
| IC4 | UDN5703 buffer IC (o/c) (See Note 2) |
| LED1, LED3 - LED5 | 3mm red LED |
| LED2 | 3mm green LED |
| D1, D2 | 1N4007 power diode |
| VDR1, VDR2 | 33V Voltage dependand resistor |

#### Miscellaneous

| | |
|---|---|
| Main board | PCB (172 x 77mm, coded 99mc12a) |
| X1 | 4MHz ceramic resonator |
| K1 - K10 | PCB screw type terminal blocks |
| S1 | PCB push switch |
| F1 | 15A fuse |
| SK1 | 28-pin IC socket |

TO-220 horizontal heatsinks
M3 machine screws, nuts, spacers, etc.

### Power module

#### Resistors

(all 1/4 watt)

| | |
|---|---|
| R1 - R10 | 2.2 ohms |
| R11 | 220 ohms |
| R12 | 2.2k |

#### Capacitors

| | |
|---|---|
| C1, C2 | 100uF |
| C3 | 100nF |

#### Semiconductors

| | |
|---|---|
| Q1 - Q10 | NDP7050 or NDP7060 power mosfets |
| IC1 | TC4426 dual inverting mosfet driver |
| IC2 | LME0512S 5V:12V DC-DC converter |
| IC3 | HP4502 optocoupler |

#### Miscellaneous

Power/diode module PC board (50 x 60mm, coded 99mc12b)

| | |
|---|---|
| K1, K2 | screw type terminal blocks |
| B1 - B20 | Ferrite suppressor beads, Philips 020-15460 or equiv. |

Aluminium bar 32 x 6mm and 19 x 6mm
heat sink 200 x 150mm, flat on one surface
M3 panhead and M3 countersunk machine screws
M6 panhead machine screws
Plastic transistor insulating bushes
Brass terminal lugs for mosfets
Brass shim for ground connection

### Diode module

#### Resistors

| | |
|---|---|
| R1 - R10 | 2.2 ohms |
| Q1 - Q10 | NDP7050 or NDP7060 power mosfets |

Power/diode module PC board (50 x 60mm, coded 99mc12b)
Hardware as per power module

### General

3mm aluminium mounting panel to mount power and diode modules.
Thermal conductive sheet, 105 x 160mm
Fuse or circuit breaker to suit vehicle, if not already existing.
Key operated start switch.
Contactor (relay) 24 volt 750 amp rating
Reversing beeper

**Note 1:** If a programmed 87C752 is not available locally, the authors can assist — email the author at: brent.brown@clear.net.nz
**Note 2:** These items may be hard to locate — again, email Brent if help is needed.

Make sure that the driver PCB has the ground plane 'via' soldered in, and that the driver PCB is connected to the lower cross bar with copper shims as explained above.

## Wiring and housing

The vehicle wiring and the interconnections of the power and diode modules are shown in Fig.8. For reliability, the power control potentiometer (accelerator) is actually two 2.2k slide potentiometers in parallel.

The power and diode modules are bolted to their mounting panel and heat sink as shown in Fig.5. They have no housing, but are mounted under the tray of the vehicle, close to the battery and motor, and hence receive some weather protection.

The main board was mounted in an existing compartment beneath the drivers seat, so no new housing was required.

## Tests and adjustments

You might like to leave the motor armature disconnected while you carry out some initial tests. Connect everything else and power it up. If you have an oscilloscope, look at the PWM output leads from the microcontroller board. As you alter the accelerator potentiometer, the duty cycle of this pulse stream should go from very small to very large. The object of the adjustments is to give a duty cycle of zero when the accelerator is closed, and 100% when fully open.

Start by fully closing the accelerator. Now adjust the 'Zero' trimpot and the duty cycle should go from zero to a small pulse width. Set the trimpot so that the output is just zero, and only a small movement of the power control is needed to make it non-zero. Leave enough accelerator freeplay so that movement of handlebars etc, will not produce an output.

Connect a voltmeter across the field winding, and check that the field voltage comes on when the accelerator is moved off zero, and disappears when the accelerator is returned to zero. Check also that the reverse switch reverses the field voltage.

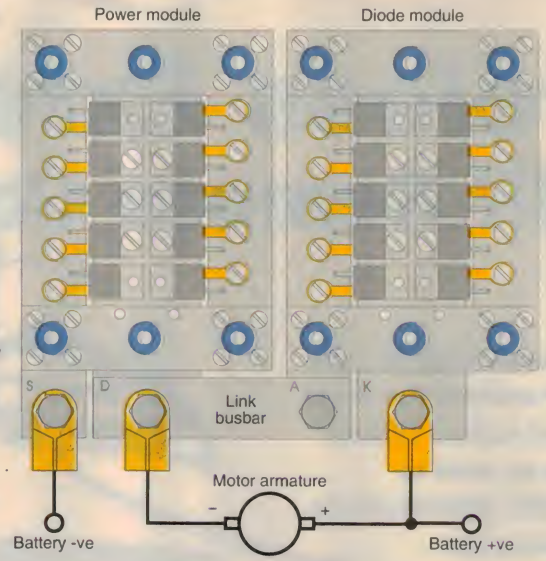
Now fully open the accelerator, and set the 'Speed gain' trimpot so that a 100% duty cycle is obtained. The full range of power is now available by moving the accelerator. Further increasing the 'Speed gain' pot will give 0-100% duty cycle over a smaller range of accelerator movement.

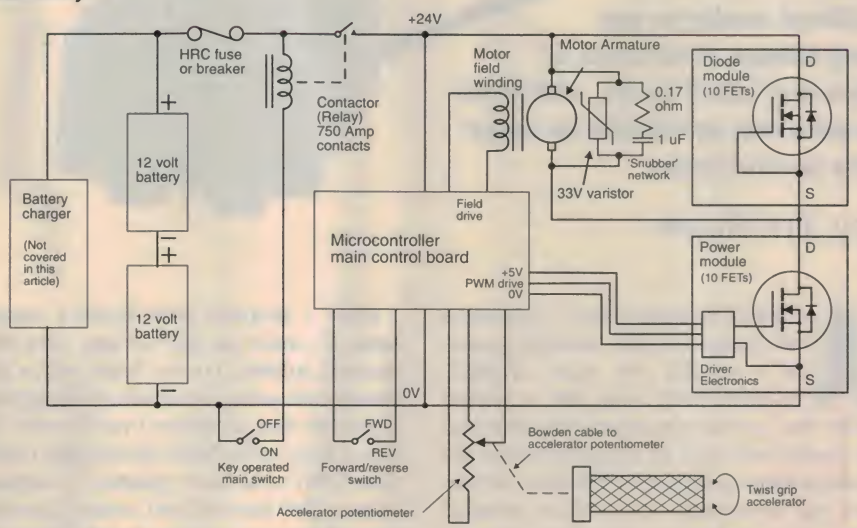
Now connect the armature, raise the drive wheels from the ground, and check that everything works. The 'PWM freq' trimpot may be adjusted to suit. A higher frequency gives smoother, quieter control, while a lower frequency can feel rougher but appears to give better accelerator response at low speeds. Experiment with this to see what sounds and feels good with your motor. ❖

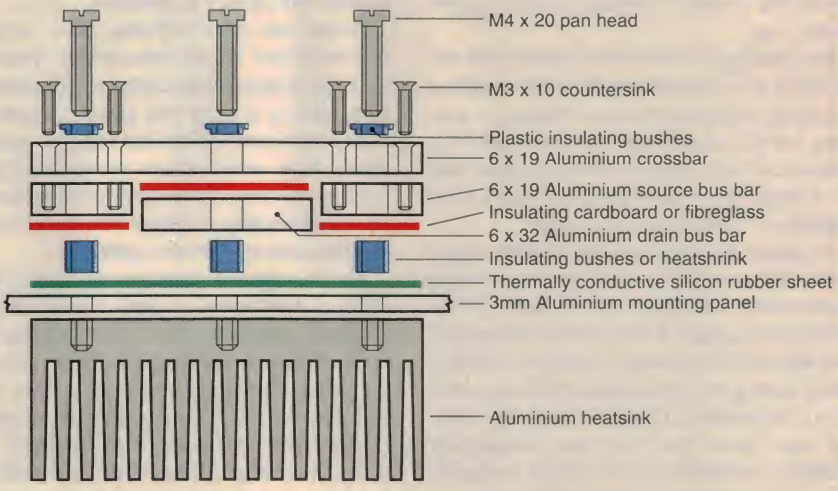
***At right is Fig.9, showing the physical construction of the aluminium busbars and power/diode modules. Also shown are the connections to the battery and motor.***

***Fig.8 (below), is a block diagram which gives an overview of the whole system.***

***Fig.5 (bottom) shows the end view of the power/diode module assembly.***



# Wireless Extender for IR Remote Controls

***Here's a low cost, easy to build project which extends the range of an infra-red remote control so that it can be used to operate its VCR, DVD/CD player or Pay TV set-top box from another room — without having to run any cables. It consists of two very small boxes, which use a data link at 433MHz to 'relay' the control codes.***

by Jim Rowe

A COUPLE OF MONTHS ago, I reviewed a commercial wireless extender system for IR remotes (the Jaycar AR-1805, November 1999 page 86). It worked really well, and using it I realised that this kind of system was ideal for situations where you want to watch a movie in a different room from the one where your VCR, DVD or laserdisc player is located. You can still have full use of the player's remote control (especially important for DVDs!), but without the hassle of running extra cables between the two rooms...

This kind of setup is also very suitable for controlling a Pay TV set-top box from other rooms, too.

But although commercial systems like the AR-1805 do work very well, they also seem a tad pricey. Which started me thinking — perhaps it might be possible to come up with a 'make your own' version, which could be built for a significantly lower price. So that's what started me working on this project.

Of course this type of system tends to rely on a low-power UHF transmitter and receiver combination, and these can be quite a hassle for many people if they have to be built up and aligned from scratch. However I remembered seeing an advertisement from another of our advertisers, Oatley Electronics, offering very small and low cost pre-aligned 433MHz transmitter and receiver modules, apparently designed for this kind of use.

When I enquired from Oatley's Branco Justic, it turned out that not only were their modules suitable, but his team had in fact already done quite a bit of work on using them in just the kind of system I had in mind. So after a quick visit to Oatley the next day, I found myself with a box full of 'goodies' — samples of their UHF transmit and receive modules, some IR receiver modules that looked to be suitable too, a couple of the low cost DC plugpack supplies they're selling, some handy C8050 NPN switching transistors, plus a floppy disk with the files for some prototype PB boards that Oatley had designed.

Thanks very much to Oatley, then, I was off to a flying start. It didn't take long at all to build up some prototype transmitter and receiver circuits, and do a bit of 'fine tuning' to optimise their performance. Very soon I had the system shown here, which seems to work very well using parts which should have an all-up cost of no more than $60 — around half that of a commercial wireless extender system.

As you can see from the photos, it consists of two parts — both housed in the smallest standard 'UB5' sized plastic jiffy boxes. The transmitter unit sits on your TV (or nearby) and detects the IR pulses from your remote, which it then retransmits on the UHF band at 433.9MHz or thereabouts.

The matching receiver unit then picks up the UHF signals, detects and remodulates them with the 38kHz ultrasonic carrier used by IR remote systems, and uses them to pulse a pair of IR LEDs facing your VCR or DVD player. So as far the VCR or DVD player is concerned, it's just as if your remote was in the same room and controlling it directly.

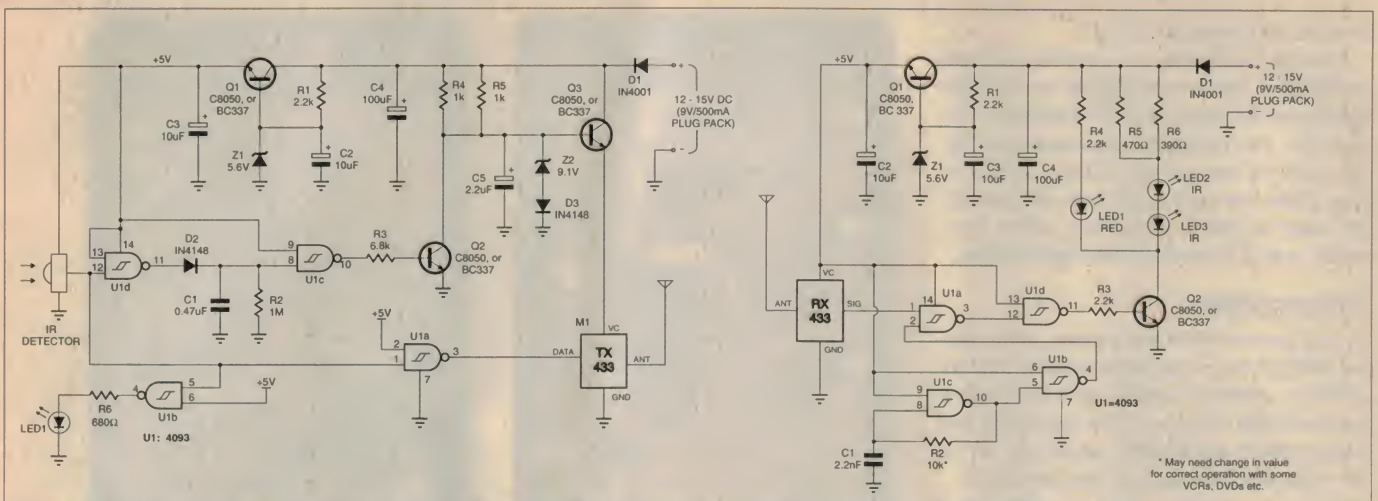
## How it works

As you can see from the schematics, both the transmitter and receiver are surprisingly straightforward. This is largely because 'the hard part' is performed within the UHF transmitter and receiver modules.

If you look at the transmitter schematic, the command codes from the remote control are first picked up by the IR receiver device. This detects the IR bursts with a photodiode, removes the 38kHz subcarrier used to prevent interference from stray lighting changes, and delivers a clean active-low logic signal version of the code pulses.

There are actually two different kinds of IR receiver available that can be used in the project. One is a fully integrated IC in a modified three pin TO-92 package, fitted with a greenish plastic lens-and-filter sleeve. This type is sold by various firms (DSE sells one as Cat No. Z-1955, Jaycar as Cat No. ZD-1952), for around $5.95 each.

The other kind of IR receiver comes as a module in a very small (15 x 12 x 11mm) metal shield box, with a separate IR detector




***The schematic for the transmitter unit is at left, while that for the receiver unit is at right. As you can see they're both quite simple and straightforward thanks to the two UHF modules.***

diode and receiver/filter IC, plus a few passive components. It's currently available as the HC-312 (IRX2) from Oatley Electronics, for only $5 each.

I can't detect any difference in performance between the two types, and because of this I've designed the project to take either. You can take your pick.

From the IR receiver, the control codes pass through gate U1a (wires as an inverter to change the pulses to 'active high' polarity) to the data input of the TX333 UHF transmitter module M1. This then uses them to modulate a 433.9MHz carrier, to send them to the receiver.

But if it's that simple, what then is the purpose of the rest of the circuitry? Well, U1b is used to drive visible LED1 with the received pulses (via R6), so the transmitter gives you a visible indication when it's receiving the pulses from your remote — very reassuring, and an aid to setting things up.

The rest of the circuitry is used for either power supply regulation, or power control. For example zener diode Z1 and transistor Q1 are used in a simple regulator (with R1, C2 and C3) to derive a smooth and steady +5V DC from the unregulated 12-15V input from the plug-pack supply. The +5V is used to supply the IR receiver and IC U1, a quad Schmitt gate. Diode D1 is used to ensure that the circuit can't be damaged by inadvertent connection of the plug-pack with reversed polarity, while C4 provides additional smoothing and acts as a reservoir.

The rest of the circuit is essentially another voltage regulator, used to provide the +9V needed by the UHF transmitter module. However this supply can't be allowed to operate continuously, because the regulations for this type of wireless remote control link only allow the UHF carrier to be transmitted when the codes are actually being sent (to minimise any possible electromagnetic interference/pollution). So we have to arrange for the circuit to turn the transmitter on only when our code pulses need to be transmitted, and then off again.

This is done as follows. Transistor Q3, with zener diode Z2 and its series diode D3, forms the basic +9V regulator, with current fed to the zener and Q3's base via resistors R4 and R5, and C5 providing some additional smoothing. But the regulator can only deliver +9V to the UHF transmitter module when transistor Q2 is turned off; when it's turned on, it shunts Z2 and D3 and pulls the base voltage of Q3 right down to within a couple of hundred millivolts of ground potential — turning off both Q3 and the transmit module.

So we control the operation of the +9V regulator and M1 simply by turning Q2 on and off. When Q2 is on (its normal state), the transmit module is turned off. We turn the module on briefly when it's needed, by turning off Q2.

As you can see Q2 is in turn controlled indirectly by the control code pulses themselves, via a simple 'fast attack-slow decay' circuit. Gate U1d, wired as an inverter, buffers the pulses from the IR receiver and controls the charging of capacitor C1 via diode D2. As soon as the first pulse arrives, pin 11 of U1d goes high, and C1 is charged up to almost +5V within a few milliseconds. This causes the output (pin 10) of remaining inverter U1c to drop to 0V, and since the base of Q2 is fed from this output via R3, this turns off Q2 — turning on the transmitter.

Although C1 can charge up rapidly via D2, its only real discharge path is via 1M resistor R2. As a result, Q2 is kept firmly off for the duration of the control pulses — and for a few hundred milliseconds after the last pulse. But then C1 discharges sufficiently via R2 to allow U1c to switch back to the condition with its output at +5V. So Q2 is turned back on again, switching off the transmitter until next time it's needed.

As you can see, everything is controlled by the incoming control code pulses. The +5V regulator remains on all the time, providing the few milliamps needed by the IR receiver and IC, but the +9V regulator and the transmitter module are only turned on when pulses are being transmitted.

## The receiver

Now let's look at the receiver circuit, which is a simpler in operation.

Here we have another simple +5V regulator circuit, using transistor Q1 and zener Z1. In this case it supplies the UHF receiver module M1 and U1, another 4093 quad Schmitt NAND gate.

When the receiver module detects a signal from the transmitter, it delivers the code pulses from its signal output and presents these to pin 1 of U1a. Here they are used to gate 38kHz pulses generated by the oscillator formed by U1c and C1/R2, and fed to pin 2 of U1a via U1b, used as a buffer. As a result, the pulses which emerge at pin 3 are effectively re-modulated with the correct 38kHz subcarrier used to provide noise immunity in IR remote control systems.

These 38kHz tone bursts are then fed through buffer inverter U1d, which drives transistor Q2 via base resistor R3. So Q2 is turned on at a 38kHz rate, during each of the received code pulses. And as you can see, Q2 is used to switch the current through IR transmitting LEDs 2 and 3, to produce the regenerated IR control pulses for your VCR, DVD player or whatever. At the same time it also switches the current through visible LED 1, so the receiver again gives you a clear indication when it's receiving and relaying control pulses.

Parallel resistors R5 and R6 are used to set the current level through the IR transmit LEDs, while R4 sets the somewhat lower current level though the visible LED. As before diode D1 prevents damage due to accidental reverse-polarity connection of the plug-pack supply, while C4

# Wireless Extender for IR Remote Control

provides additional smoothing.

Both the transmitter and receiver units are designed to run from plug packs or any other convenient DC power source of between 12V and 15V. The prototypes operated very happily from the nominal 9V/500mA 'Audiovox' plug packs currently being sold very cheaply ($5 each) by Oatley Electronics, which deliver just over 12V with this very light loading.

## Construction

As you can see from the photos, both units are built up on printed circuit boards only 62 x 46mm, which fit neatly in each case into a standard UB5 utility box. The two boards are coded A0ITX1 and A0IRX1, where the 'A0' is the code *EA* is adopting for the year 2000.

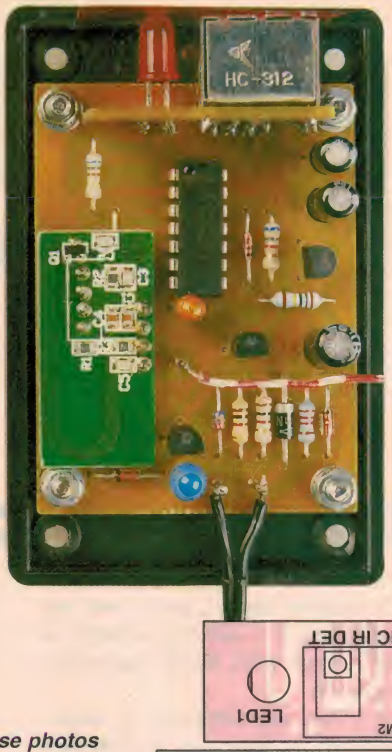
There's a second and very small (32 x 18mm) 'helper' board for the transmitter, which is used if you want to use the IR receiver module from Oatley. It mounts both this module and the 'visual confirmation' LED, and converts the connections for the receiver module so they match those of the alternative integrated IR receiver (which mounts directly on the main board, if it's used).

Assembling both units should be fairly straightforward if you use the closeup photos and the PCB overlay diagrams as a guide to component placement and orientation. I used PCB terminal pins for the DC input and UHF antenna connections on both boards, with five extra pins on the transmitter board if the 'helper' board is used. These pins go in the positions otherwise occupied by the integrated IR receiver and LED, and are used to both support and connect to the helper PCB.

As usual it's a good idea to fit the low-profile resistors and diodes to the boards first, taking care with diode polarity. Then you can fit the capacitors, again watching the orientation of the electrolytics. Don't forget the single wire link on the transmitter PCB, which must be fitted before the UHF transmitter module (because it's largely underneath it).

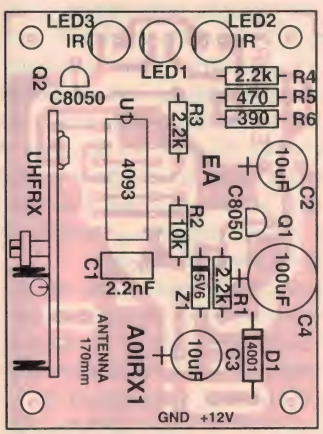
After this you can fit the transistors and ICs, again taking care to fit them correctly. Note here especially that the overlay diagrams show the orientation for the C8050 transistors (available from Oatley for 25 cents each), which have different connections from the electrically very similar BC337. **If you use BC337s, they must be fitted around the opposite way (i.e., flat on the opposite side), and with the centre base lead carefully cranked over to the opposite side of the two outer leads, from the way it comes.**

Finally the UHF transmitter and receiver modules can be added to each board. The transmit module mounts horizontally but upside-down, with its crystal underneath against the main PCB, and with its four connection pins soldered to the pads provided. The receiver module mounts vertically, with its small 'fine tuning' trimmer towards the outer edge of the main PCB. It has four pins at one end and two near the other, which again mate with the pads provided.

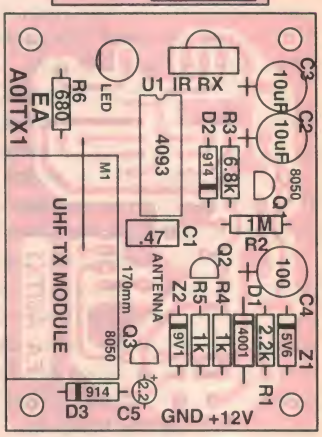









***Use these photos and PCB overlay diagrams as a guide to wiring up the two boards. The optional 'helper' PCB is needed for the transmitter (L) when you use Oatley's IRX2 IR receiver module in place of the fully integrated type.***

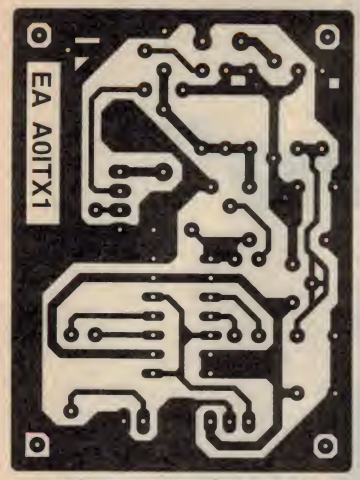


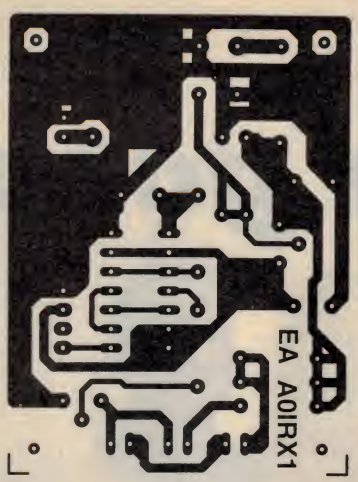

Both boards mount centrally in the 'lids' of the UB5 boxes, which are used 'upside down' with small rubber feet to protect the surface they're placed on. Each board is mounted using four M3 x 9mm machine screws, with a star lockwasher and M3 nut fitted to each screw first to space the boards up by about 2mm. Then a further lockwasher and nut are used above the board, for the actual attachment. It's all fairly straightfoward, although fitting the nuts at the front of the transmitter board can be a bit tricky if you're using the 'helper' board. (You may need to file a little from the ends of the helper board, to make things easier.)

The main part of each UB5 box becomes the new 'lid' for each unit, and needs to have holes cut to clear the various 'ins and outs'. I cut and filed a small 3mm wide slot at the rear of each to clear the DC power cable from the plug packs, and also drilled a 1.5mm hole at the appropriate location on each 'top', to clear the vertical UHF antenna wires. Then in the 'front' of the transmitter box I carefully cut and filed a central 25 x 10mm rectangular hole, to allow the IR receiver and LED to be in full 'view'. A small piece of thin red filter material was added later inside the lid and behind this 'window', to keep out dust.

Similarly I drilled three 5mm diameter holes in the front of the receiver box (on centres 7mm apart), to allow the three LEDs to protrude. You might also want to drill a 3mm hole in the right-hand side of the receiver box, to allow adjustment of the UHF receiver module's fine tuning trimmer without removing the lid.

Before the finished 'lids' are fitted to the units, the UHF antennas are prepared and soldered to the appropriate PCB pin on each board. Both are simply 170mm lengths of straight wire, which can be either insulated or




*Use these actual-size PCB patterns if you want to make your own boards. If you're not using the IRX2 IR receiver module in the transmitter unit, the small helper board at lower left isn't needed.*

tinned-copper hookup wire (stretched slightly to straighten and stiffen it), or cut from 0.5mm stiff brass wire.

With each antenna fitted, the lid of each case can be 'threaded' on the wire and lowered over the board assembly, tilting it forward gently in the case of the receiver board to allow the LEDs to protrude through their clearance holes. Then, after checking that the DC power leads are neatly in their entry slots, the lids can be fastened to each case with the screws provided.

Both units are then complete, although you may want to bend the top of each antenna wire into a small loop, to prevent anyone being accidentally 'speared'.

## Checkout time

Once the units are assembled, checking them out is fairly simple. The main things you'll need are your IR remote control unit and the piece of gear it controls, plus possibly a small insulated screwdriver or alignment tool.

First you can check the transmitter unit, by applying power via its plug pack. The LED may 'blink' very briefly when power is applied, but then it should remain dark — until you point your remote at its front window, and press one of its buttons. Then the transmitter's LED should blink reassuringly, to confirm that it's receiving and relaying the codes correctly.

If it doesn't blink correctly, switch off and remove the cover to check for wiring mistakes. You may have connected the plug-pack lead with reverse polarity, so the circuit is completely dead; or you may have connected one or more components the wrong way around. So track down the problem, and correct it...

Assuming the transmitter seems to be working correctly, now you can try powering the receiver up as well. Then with the two a metre or two apart (but not facing each other), try pointing your remote at the front of the transmitter again — this time watching the front of the receiver. Its LED should blink strongly in exactly the same way as that on the transmitter, showing that it's also receiving the codes correctly.

If it blinks only weakly, or doesn't blink at all, the odds are that the receiver module's fine tuning trimmer might need a very small 'tweak' one way or the other, to match its receive frequency tuning to that of your transmitter. This will be easy to do if you elected to provide an adjustment hole in the case; otherwise you'll have to remove the lid again temporarily, to make the adjustment.

Either way, it's simply a matter of using your very small screwdriver or alignment tool to make *very small* adjustments to the trimmer setting, until you find the position for best 'reception'. Try steps in one direction first, to see if things improve or deteriorate; if the latter, try going back the other way. Then when you've found the correct approximate position, you can move the two units further apart (but with the receiver still visible) so you can zero-in on the best setting for maximum range.

That's about it. Your wireless IR extender system should now be working correctly, and you should be able to put it to use.

A final word, though: don't locate the transmitter unit where it can get a 'whiff' of the receiver's IR output pulses, even during the setting up procedure. Otherwise, you'll set up a positive feedback loop, and the two will continue 'pulsing' each other with the LEDs blinking back and forth — bit like the IR equivalent of 'howling' in a public address system when the microphone picks up too much sound from the speakers.

Normally this shouldn't be a problem, of course, as the two units will be in different rooms. ❖

## Parts list

### Transmitter Module:

***Resistors***

All 0.25W 5%:

| | |
|---|---|
| R1 | 2.2k |
| R2 | 1M |
| R3 | 6.8k |
| R4,5 | 1k |
| R6 | 680 ohms |

***Capacitors***

| | |
|---|---|
| C1 | 0.47uF tantalum |
| C2,3 | 10uF 10VW RB electrolytic |
| C4 | 100uF 25VW RB electrolytic |
| C5 | 2.2uF tantalum |

***Semiconductors***

| | |
|---|---|
| U1 | 4093 quad schmitt NAND |
| Q1,2,3 | C8050 or BC337 silicon NPN (see text) |
| LED1 | 5mm red LED |
| D1 | 1N4001 or similar |
| D2,3 | 1N914, 1N4148 or similar |
| Z1 | 5.6V 400mW zener |
| Z2 | 9.1V 400mW zener |
| IR RX | IR receiver module (see text) |

***Miscellaneous***

TX433 UHF transmit module (see text); small plastic utility box, 83 x 54 x 28mm (UB5); PC board 62 x 46mm, coded A0IRT1, with auxiliary vertical PCB 18 x 32mm if desired; plug-pack power supply, nominal 9V DC at 500mA (see text); 18 x 32mm rectangle of thin red filter material; 8 x PCB terminal pins; 170mm length of insulated copper or stiff 0.5mm brass wire; 4 x small adhesive rubber feet; 4 x M3 x 9mm machine screws, with 8 x M3 nuts and star lockwashers.

### Receiver module:

***Resistors***

All 0.25W 5%:

| | |
|---|---|
| R1,3,4 | 2.2k |
| R2 | 10k |
| R5 | 470 ohms |
| R6 | 390 ohms |

***Capacitors***

| | |
|---|---|
| C1 | 2.2nF MKT |
| C2,3 | 10uF 10VW RB electrolytic |
| C4 | 100uF 25VW RB electrolytic |

***Semiconductors***

| | |
|---|---|
| U1 | 4093 quad schmitt NAND |
| Q1,2 | C8050 or BC337 silicon NPN (see text) |
| Z1 | 5.6V 400mW zener |
| LED1 | 5mm red LED |
| LED2,3 | 5mm IR LED |
| D1 | 1N4001 or similar |

***Miscellaneous***

RX433 UHF receive module (see text); small plastic utility box, 83 x 54 x 28mm (UB5); PC board, 62 x 46mm, coded A0IRX1; plug-pack power supply, nominal 9V DC at 500mA; 3 x PCB terminal pins; 170mm length of insulated copper or stiff 0.5mm brass wire; 4 x small adhesive rubber feet; 4 x M3 x 9mm machine screws, plus 8 x M3 nuts and star lockwashers.

**(Note: The TX433 and RX433 UHF modules used in this project are available from Oatley Electronics, for $11 and $18 respectively plus postage. Oatley can also supply IRX2 IR receiver modules for $5 each, and C8050 transistors for 25 cents each (20 for $5). For more information see Oatley's web site at www.oatleyelectronics.com)**

# "We've got a fire"


**This month marks the 33rd anniversary of a tragic accident that occurred early in NASA's manned space flight program. Destined to become a mere footnote to the highly successful Apollo missions, the events surrounding the accident are not well known, and are likely to be forgotten — which is ironic, considering that it paved the way to subsequent safe and successful flights.**

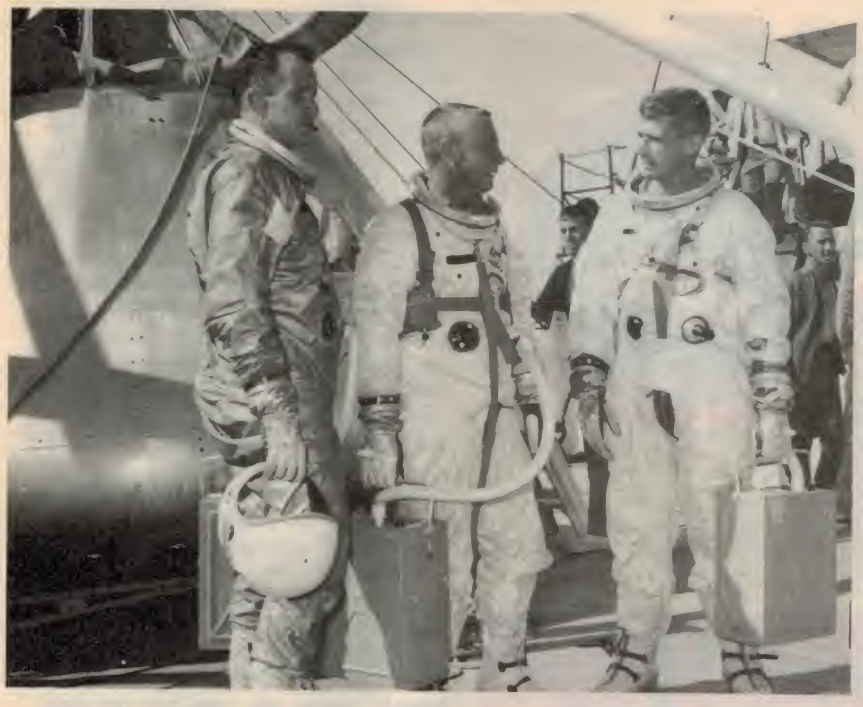
*by Kate Doolan*

By January 1966, the NASA were confident that President Kennedy's goal of putting men on the Moon by the end of the decade would be reached sometime the following year or in early 1968.

The Gemini program had completed its first successful year of operations which included the first two man flight, the first 'spacewalk' by an American, two long duration missions and the first rendezvous between two manned spacecraft. There were another five flights planned for 1966, which would include several more spacewalks and the first actual docking between two orbiting spacecraft.

With growing confidence that they were well on the way to meeting President Kennedy's goal, NASA managers scheduled the first manned Apollo flight, possibly in a dual flight with the last Gemini flight, Gemini 12.

On 21 March 1966, NASA made public the crew names and gave the flight the designation of Apollo 204. The numbering system meant it was the fourth flight of the Saturn IB vehicle. Saturn I flights were numbered in the



*Far left: Astronauts Virgil I. Grissom, Edward H. White II, and Roger B. Chaffee pictured during training in Florida. Left: The crew suited up onboard the NASA Motor Vessel Retriver.*

200s and Saturn V flights in the 500s.

The crew was a mixture of experience and youth. Commanding the flight would be Virgil 'Gus' Grissom, one of original Mercury astronauts who had already made two spaceflights including the first Gemini flight. Named as Senior Pilot was Ed White who had enthralled the world a year earlier when he had become the first American to walk in space. The Pilot was to be Roger Chaffee a 31 year old space rookie.

NASA had given Grissom the option of an open ended mission and it was expected that the flight would last between 14 and 16 days. The main goals of the first Apollo mission was to check out launch operations, ground tracking and control facilities, as well to carry out a thorough evaluation of the launch vehicle and Apollo spacecraft.

Parts of the 204 spacecraft began arriving at the Kennedy Space Centre (KSC) in Florida during August 1966. On 26 August 1966, the Command Module (CM) arrived from the North American Aviation (NAA) factory in California and by early September the CM had been attached to the Service Module.

## Scathing report

Unknown to the astronauts, public and media, a team led by Apollo Program Manager General Sam Phillips had visited the NAA factory during 1965 and written a scathing report on NAA and its deficiencies. Costs for the spacecraft had increased dramatically, and both the Command Module and Saturn IB second stage were well behind schedule.

'The Phillips Report' also found serious technical deficiencies in the welding and insulation of the Saturn IB and stress corrosion in the Command/Service Module (CSM). The report stressed that NAA's inability to meet its deadlines had caused the rescheduling of the whole Apollo program. With regard to the CSM, "there is little confidence that NAA will meet its performance and commitments". General Phillips visited the factory again in April 1966; he did not amend his conclusions but told various managers that he thought that the NAA was moving in the right direction.

On 18 and October 1966, the Apollo 204 crew participated in the first checkout of the spacecraft in an altitude chamber. Problems continued during these tests and at that time, NASA gave up the idea of launching AS 204 in 1966, postponing the flight until February.

Early in January 1967 the CSM was removed from the altitude chamber and moved to Launch Pad 34, where it was attached to the Saturn 1B booster. On 23 January, NASA publicly announced that the launch date was rescheduled to 21 February. Three important objectives were to be met before the launch; they were a 'plugs out' test, the Flight Readiness test and the Countdown Demonstration test. The 'plugs out' test was scheduled for 27 January and would be a rehearsal of everything that would occur during the countdown on the morning of the launch.

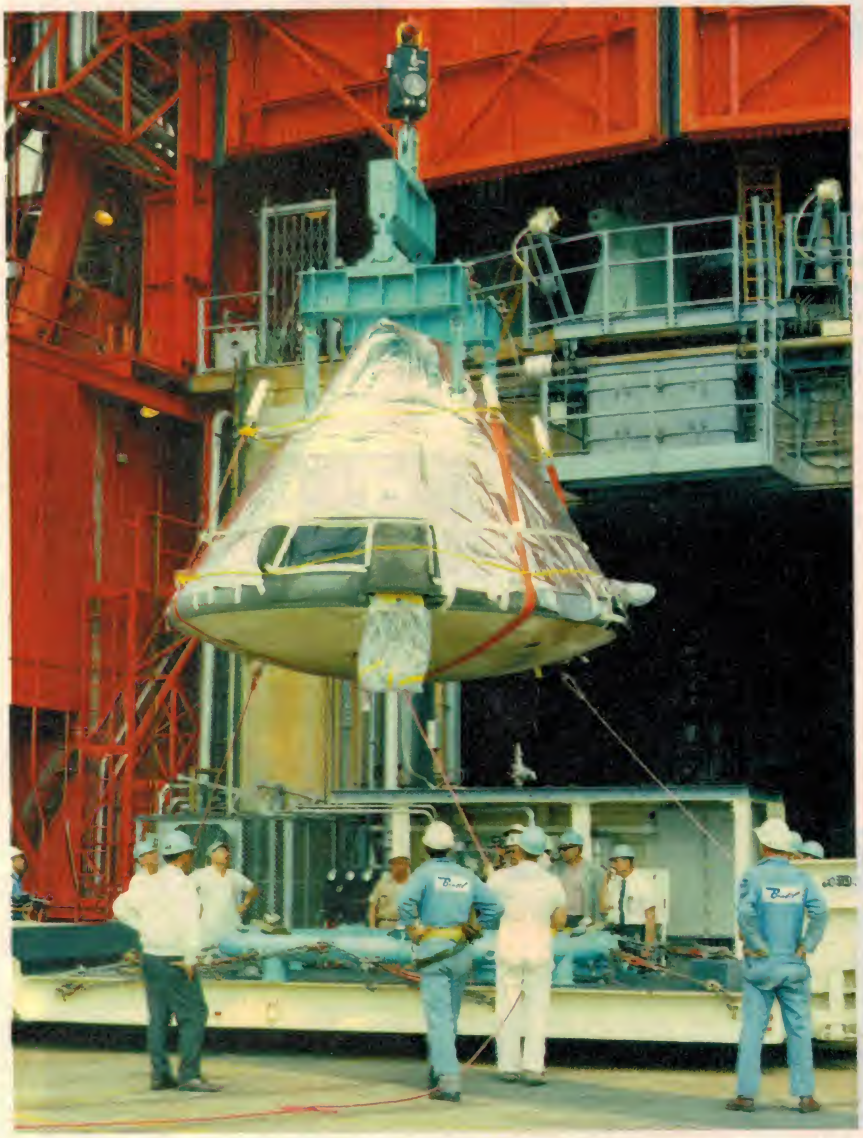
The test began with over a thousand people participating at KSC and the Manned Spacecraft Centre in Houston, Texas. Testing of the spacecraft continued throughout the morning and at 1:00 pm (Florida time) the crew entered their spacecraft. On entering the spacecraft, Gus Grissom detected an odour in his oxygen supply which he likened to "sour buttermilk", so the countdown was stopped while ground technicians took samples of the oxygen.

The countdown started again but was ham-

***Chaffee (facing camera), Grissom and White (foreground) during water egress training for the Apollo mission 204.***

pered by communication problems between mission control and the spacecraft. Grissom was losing his temper and yelled out, "How the hell do you expect us to get the Moon if you can't people can't hook us with a ground station? Get with it out there".

At 6:31 pm, just as the countdown was to start again, there was a noticeable increase in Ed White's heart and respiration rates. Gus Grissom then yelled out "Fire!" Several seconds later, Roger Chaffee in a strangely business-like tone announced, "We've got a fire in the cockpit!" The cabin pressure begun to rise dramatically, while television coverage showed the crew desperately trying to exit the spacecraft. Chaffee turned up the lights and opened the communication links with mission control while White attempted to open the hatch so the crew could get out of the spacecraft.

Ten seconds after the fire started Chaffee again yelled out "We've gotta a bad fire, let's get out, open her up!" The last transmission heard from the spacecraft was an unidentified sharp cry of pain. Crew technicians outside the spacecraft's hatch attempted to open it but thick acrid smoke made it impossible to get near the spacecraft. Several technicians were sent down to the ground to get gas masks and fire extinguishers while others continued to try and open the hatch.

Five minutes after the fire started, the technicians finally got the hatch opened and two doctors confirmed that the astronauts were dead. Chaffee was still strapped to his seat while White was lying on the floor under the hatch. Grissom's feet were on his seat as if he had attempted to crawl under his seat to avoid the inferno. The fire was fierce but selective, as a notebook near White's headrest had hardly been touched.

Autopsies into the astronauts' deaths stated that they had died from carbon monoxide asphyxiation. It was estimated that the crew lost consciousness between fifteen and twenty seconds after the fire started. Contrary to popular opinion, the crew had not been burned to death and in fact, only suffered second and third degree burns which were not severe enough to cause their death.

The news of the fire was withheld from the public and media for two hours. At the same time, NASA Administrator Jim Webb was at the White House with other senior NASA officials and astronauts to celebrate the signing of a treaty with sixty nations including the Soviet Union banning the use of space for military purposes. After telling President Lyndon Johnson of the fire, Webb was given permission for NASA to investigate the fire — a decision that raised the ire of some politicians and journalists. The following morning, Webb announced that Dr Floyd Thompson head of the Langley Research Centre would lead the investigation into the fire.

On the morning of 31 January in the presence of President Johnson, Gus Grissom was buried with full military and NASA honours at Arlington National Cemetery. That afternoon, Roger Chaffee was buried next to him. Ed White was interred the same day at his beloved United States Military Academy at West Point in New York.

## The investigation

Two weeks later, Command Module 014, which was to make the following spaceflight was shipped to the Kennedy Space Centre. To compare it with the AS 204 spacecraft, the module was taken apart piece by piece, photographed and x-rayed. To avoid disturb-

***Apollo 204 being removed from its Saturn 1 launch vehicle to be sent to the Pyrotechnic Installation Building at KSC for further investigation.***

ing the evidence in the burnt out spacecraft, a clear plastic floor was built and mounted over the damaged area. Astronaut Frank Borman, the astronaut representative to the Board of Investigation, was the only person allowed in the spacecraft. He spent hours at a time trying to determine what happened.

On 05 April 1967, the Board of Investigation presented its three thousand page report to NASA Administrator Jim Webb. The report stated that "the fire in Apollo 204 was most probably bought about by some minor malfunction or failure of equipment or wire insulation. This failure most likely will never be positively identified, and it initiated a sequence of events that culminated in the conflagration".

Investigators did discover physical evidence of electric arcing from wires with damaged insulation. During the manufacture of the spacecraft, a section of insulation from the wiring had been scraped off which provided the path for a spark. Evidence pointed to the fire starting near Gus Grissom's seat where the environmental control system had been repeatedly removed and replaced during testing. The arc had ignited flammable material and in the pure oxygen of the spacecraft, the fire had spread quickly.

One of the areas that had been thoroughly investigated by the Board was the pure oxygen atmosphere of the spacecraft. There had been warnings as early as 1964 about the extent of fire hazards in an over-pressurised spacecraft. There was an incredible amount of flammable material in the AS 204 including paper, Velcro and nylon. Once the fired started, pure oxygen continued to feed the flames until they burned out.

Another area of concern was the difficulty the crew had in trying to open the hatch to exit the spacecraft. The hatch was secured by six bolts to the spacecraft and took at least ninety seconds to open. There was an irony to all of this; in 1961, Gus Grissom's spacecraft "Liberty Bell 7" had been lost at sea after its hatch automatically detonated, filling the spacecraft with water and sinking. (In 1999, Liberty Bell 7 was found and recovered from the bottom of the Atlantic Ocean.)

Spacecraft designers then decided that an explosive hatch was too dangerous. If the Apollo 204 spacecraft had an explosive hatch, it could have been opened quickly. The Florida air would have replaced the oxygen atmosphere and the fire could have been extinguished. Gus Grissom would have suffered only minor burns and the remainder of the crew would have received a scare.

At the request of the astronauts' widows, Apollo 204 was renamed "Apollo 1". When Apollo 11 landed on the Moon in July 1969, the crew left an Apollo 1 patch as a memorial to the crew. Had he lived, it was planned that Gus Grissom would have been the first man on the Moon and he was told of this before being assigned to Apollo 1.


***A close-up view of the Apollo Spacecraft 012 Command Module in the White Room atop Pad 34, Cape Kennedy, Florida. It shows the effects of the intense heat of the flash fire which killed the crew of the Apollo Saturn 204 mission.***

Since their deaths, the astronauts have been honoured in a number of ways. In 1978, Gus Grissom posthumously received the Congressional Space Medal Of Honor. Nineteen years later, Ed White and Roger Chaffee's families received the same medal from President Bill Clinton in an impressive White House ceremony.

The bitter irony of the Apollo 1 tragedy is that it saved the American space program. Had it continued on the same erratic path, with managerial incompetence and dangerous, failing hardware, it is doubtful that NASA would have safely fulfilled President Kennedy's national commitment. Instead, phoenix-like a renewed Apollo program rose from the tragedy and the rebuilt, safer spacecraft propelled NASA's astronauts and the United States into spaceflight history.

*The author wishes to acknowledge the assistance of Colin Burgess; Deb Dodds and Jody Russell of the Johnson Space Centre; Maggie Persinger of the Kennedy Space Centre and Judy Sibley of the US Military Academy archives in the completion of this article.* ❖

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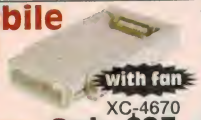

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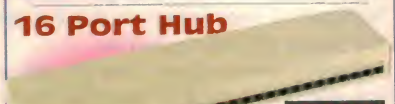

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Normally $99
Jan. $69

The Vulcan 200 has Piezo ignition, includes soldering tip, flame tip and hot air tip, stand and sponge.

SAVE $30

OVERNIGHT DELIVERY

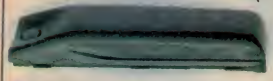
MAILORDERS - FREECALL FOR PHONE ORDERS - 1800 022 888

# OVERNIGHT DELIVERY

MAILORDERS - FREECALL FOR PHONE ORDERS - 1800 022 888

## Cellular Phone Battery Sellout

Stocks are limited on some models. See 99 Cat. page 103 for details. All are Ni-Mh (except the SB2565 Brick).



**SAVE $!!!!**

| | | Was | Now | Save |
|---|---|---|---|---|
| SB-2553 | Nokia 3110/3810 | $39.95 | 20.00 | $19.95 |
| SB-2554 | Nokia 5110 | $49.95 | 25.00 | $24.95 |
| SB-2551 | Nokia 100 | $49.95 | 20.00 | $29.95 |
| SB-2555 | Nokia 101/121 | $45.00 | 20.00 | $25.00 |
| SB-2577 | Ericsson 788 | $35.00 | 18.00 | $17.00 |
| SB-2570 | Motorola Microtac | $39.95 | 22.00 | $17.95 |
| SB-2565 | Motorola Brick | $29.95 | 10.00 | $19.95 |
| SB-2582 | NEC Fido | $35.00 | 15.00 | $20.00 |
| SB-2575 | Ericsson 788 Slim | $39.95 | 20.00 | $19.95 |
| SB-2578 | Ericsson 337 | $39.95 | 29.95 | $10.00 |
| SB-2584 | NEC Mercury | $29.95 | 15.00 | $14.95 |

## 300 Watt 12VDC to 230VAC Inverter


Was $379
Jan. $299 Cat. MI-5052

## Protek 506 Computer Connect

•Dual display •Bargraph •RS232 interface •True RMS •Auto / Manual •3.75 Digits •4000 count •Relative mode •Recording (min, max, avg) •Time mode •10 memories •Data hold •Back light •Input warning •10MHz frequency •Capacitance •20A •Inductance •Temperature •dBM •Logic •Diode •Continuity •Signal out •Auto power off/on mode •Holster

Was $329 **Jan. $269** Save $60 QM-1290

## 5 Piece Hex Nut Driver

Sizes 3, 3.5, 4, 4.5, 5mm.

**Was $7.95 Save $3**
**Jan. $4.95** Cat. TD-2006

## Save on PIC Microcontrollers

See catalogue pages 20/21 for details.

**BASIC STAMP 1 (REV E)**
Cat XS-5510
WAS $79 JAN $69 SAVE $10

**BS-II IC PARALLAX CARRIER BOARD** Cat XS-5550
WAS $49 JAN $39 SAVE $10

**MINIMOD BS-1**
Cat. XS-5524 WAS $64.95
JAN $54.95 SAVE $10

**BS-I CHIPSET** Cat. XS-5514
WAS $49.95 JAN $39.95 SAVE $10

**BS-I IC PARALLAX CARRIER BOARD** Cat. XS-5540
WAS $39 JAN $32 SAVE $7

**STAMP BUS MOTHERBOARD**
Cat. XS-5528
WAS $99.50 JAN $85 SAVE $14.50

**BS-I / BS-II DEVELOPMENT BOARD** Cat. XS-5526
WAS $129 JAN $119 SAVE $10

## Save on Kwik Kit Modules

See Cat. pages 22 & 23 for details.

**ELECTRONIC CARD SWITCH**
Cat. AA-0335
WAS $27.95 JAN $19.95 SAVE $8



**AUTO BATTERY CHARGER**
Cat. AA-0250
WAS $34.95 JAN $20 SAVE $14.95

**TWIN LEAD ACID BATTERY CHARGER** Cat. AA-0255
WAS $27.95 JAN $19.95 SAVE $8

**24 TO 12V 1.1A REDUCER**
Cat. AA-0265
WAS $24.95 JAN $17.95 SAVE $7

**FAKE ALARM FOR CARS**
Cat. AA-0280
WAS $12.95 JAN $7.95 SAVE $5

**12VAC 50W DIMMER FOR HALOGEN LAMPS + MOTORS**
Cat. AA-0319
WAS $39.95 JAN $24.95 SAVE $15

**12VAC 50W FLASHER FOR HALOGEN LAMPS** Cat. AA-0300
WAS $39.95 JAN $24.95 SAVE $15

**FLASHER 12 - 24V @ 8A**
Cat. AA-0307
WAS $27.95 JAN $17.95 SAVE $10

## Computer Speakers

See 99 Cat. page 191.

LARGE XC-5164
36W PMPO per speaker. 170mm high. Includes 1.2A 240V. Power supply. Was $49.95 pair
**Jan. $29.95pr** Save $20

JUMBO XC-5165
120W PMPO / speaker. 213mm high. Includes 2.5A 240V power supply.

Was $79.95 pair Save $30
**Jan. $49.95 pair**

## Acoustic Sound Absorbing Deadening Material

Ideal for car sound, etc.
See 99 Cat. page 73.

**STANDARD** AX-3680
Was $8.95 sheet
**Jan. $6.95** sheet
Save $2
Size 700x330x2.3mm

**WITH ABSORBING MATERIAL** AX-3682
Was $14.95 sheet
**Jan $11.95** sheet
Save $3
Size 680 x 330 x 4.5mm

## Sound Absorbing Acoustic Tiles

See 99 Cat. page 73. Both tiles 300 x 300mm. Supplied as a pair, so buy 1 and you get 2.

25MM TILE AX-3652
Was $13.95
**Jan. $10.95**
Save $3
BUY 10 WAS $12.50
**Jan. $10.00**
Save $2.50

38MM TILE AX-3656
Was $16.95
**Jan. $13.95**
Save $3
BUY 10
WAS $14.95
**Jan. $12.50**
Save $2.45

## JAYCAR CAR ACCESSORY BARGAINS

### Car Bass Driver with Remote

Cat. AA-0426
See Cat. page 72.
Was $129
Save $40
January $89

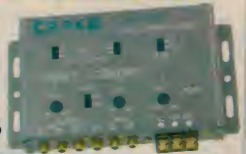
### 15 Band Car EQ Cat. AA-0422

With 2 way crossover and remote sub volume control.
See Cat. page 72.

Was $299
January $179 Save $120

### 2 Way Car Crossover

Cat. AA-0450
50 units only.
Was $99.95
Save $30
Jan $69.95



### 4 Door Car Central Locking Kit

Was $59
Save $10
**January $49** Cat. LR-8830

See Cat. P78. Beware of inferior quality sets.

### Legend Platinum Car Alarm

Protect your car in January, and save $$$. See Cat. page 80 for details. Both units include 2 remotes, shock sensor, wiring harness, dash LED, built in disable relay.

LEGEND WITH STD SIREN
Cat. LA-8915
Was $159.50 Save $30
**Jan. $129.50**

LEGEND WITH BACKUP BATTERY SIREN Cat. LA-8916
Was $179.50 Save $30
**Jan. $149.50**

### All in 1 Car Alarm

1 learning remote, 2 or 3 wire easy connection. Spare remotes $19.95
Was $89.50 Save $20
**Jan $69.50** Cat. LR-8980

### Car Power Window Kit

These mount in-door. For 2 windows, 4 door cars - buy 2! Cat. LR-8840
Was $249
Save $80 **Jan $169**


## COP Home Wireless Alarm System

System includes control panel, PIR, remote and reed switch - all wireless, and power supply. Not available wholesale or trade.

ONLY 25 SYSTEMS

**Buy the System in January for $329 and receive free:**

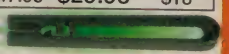
| | Value |
|---|---|
| 2 x Wireless Reed / Magnetic Switch LA-5493 | $95.90 |
| 1 x Remote Control LA-5492 | $42.95 |
| FREE EXTRAS | $138.85 |

Cat. LA-5490

### NEED MORE ACCESSORIES FOR THE ALARM

| CRAZY JANUARY PRICES | Was | JAN | Save |
|---|---|---|---|
| WIRELESS PIR LA-5491 | $79.50 | $49.50 | $30 |
| REMOTE CONTROL LA-5492 | $42.95 | $26.95 | $16 |
| REED/MAGNET SWITCH LA-5493 | $47.95 | $29.95 | $18 |

### Zirconia Ceramic Tweezers



See 99 Cat. page 129 for details.
Antistatic, ideal for SMT. Cat. TH-1751
Was $49.95 Save $10
**January $39.95**

### 4 in 1 Ceramic Alignment Tool

Ceramic alignment tool

Tips include 3 slotted and1 Phillips. Slotted - 0.4 x 0.9, 0.4 x 1.8, 0.4 x 1.3 Phillips - PH1.7 Suitable for 2 - 2.5mm coil adjustment.Cat. TH-1808
Was $21.95 **Jan. $14.95** Save $7

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OVERNIGHT DELIVERY

OVERNIGHT DELIVERY

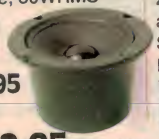
## SOUND / LUGGAGE SAFETY BELT

Designed for a walkman, but ideal as a safety pouch. See 99 Cat. page 58 for details.

Was $9.95 Jan. $4.95
Save $5 Cat. AR-1790

## Speaker Bargains

### Cone Midrange



Black PP cone, 80WRMS handling. See Cat. page 40.

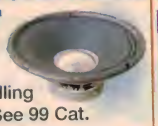
Was $32.95
Save $10
Jan. $22.95 CM-2080

### 15" Re/Sponse Woofer

4 and 8Ω available. Pressed paper cone, 250 WRMS. 40 x 8Ω and 60 x 4Ω available. See Cat. P44 for 8Ω and P68 for 4Ω details.

Were $329.50ea Save $100
Now $229.50ea
4Ω Cat. CS-2248 8Ω Cat. CW-2148

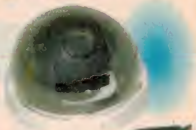
### 10" Instrument Speaker



Ideal for guitars etc. Power handling 65WRMS. See 99 Cat. page 45 for details.

Was $62.95 CG-2376
Jan. $40 Save $22.95

## Colour CCD Dome Camera



Only $239

Ideal for mounting on a ceiling. Camera can be adjusted to almost any angle. CCD camera, not low quality CMOS pick up sensor. Great for shop security. Dome diameter 87mm. Cat. QC-3484

## Budget 8 Sector Alarm Kit Sellout

60 ONLY

Includes panel, 2 PIRs, siren, power supply, cable, switches and warning stickers. Normal price for goods is $265

Kit Price $199
January Price $159
Save $40 Cat. LA-5450

## 4 Sector Home Alarm

Includes panel, PIRs, 3 reed/magnets, siren, power supply. See Cat P84 for details

Was $129.50
Save $30
January $99.50 Cat. LA-5410

## Reversing & Parking Sensor

Gives a warning which tells the distance between the rear of the vehicle and any object in the path of the reversing vehicle. The ultrasonic sensor provides a 4 stage audible/visual warning. Supplied with sensor, cabling, hardware & instructions. Cat. LR-8860

SAVE $20

Only $69.95

## Mini Gas Torch

Refillable. Has flame adjustor and on/off switch. Height is 110mm. Cat. TS-1682

Was $21.95 Save $5
Jan $16.95

## Bargain Bags

"Lots of Junk"! Cat. XB-9000

NEW BATCH!

Was $17.95
Jan. $15 Save $2.95

## Attache Case Bargains

Both are aluminium, & size is 450(W)x320(H)x145(D)mm.

### STANDARD CASE

With dividers and tool pallet in the lid. Cat. HB-6352

Was $59.95 Save $12
Jan. $47.95

### FOAM INSERT

Includes perforated foam insert for holding items like cameras etc. Cat. HB-6356

Was $69.50
Save $12
Jan. $57.50

## 9V 150mA Ni-Mh Battery

NEW

This battery has 50% more current capacity than our Nicad version. Recommended discharge current 15-300mA. Charge at 15mA for 14 hours at 20°C. Cat. SB-2469

Only $17.95

## Duratech Solder Station

$189

SAVE $$$

Cat. TS-1380

See 99 Cat. page 128 for details

Free $30 credit note with every purchase

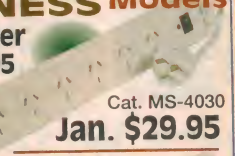
Not available for wholesale/trade

## 30 Piece Driver Set

See 99 Cat. page 130. Limited quantity. Cat. TD-2000

Was $11.95 Save $4.45
January. $7.50

## MAINS FILTER MADNESS 6 Outlet Models



Mains Filter
Was $36.95
Save $7 Cat. MS-4030
Jan. $29.95

## Mains / Phone Filter

Cat. MS-4035
Was $44.95
Save $8
Jan. $36.95

DONT PAY $49.95

## Tamper Proof Torx Key Set

7 different size tamper proof Torx bits. Torx bits are: T10, T15, T20, T25, T27, T30, T40. Cat.TD-2054

Jan. $9.95 Save $5

## Save $$$ on Aura Interactor

### BACKPACK

Now includes N64 / Playstation leads Cat. XC-1000

save $10

ONLY $39.95

### CUSHION

includes N64 / Playstation leads Cat. XC-1005

ONLY $39.95

save $20

AURA INTERACTOR

## Large Digital Clock with Humidity & Calendar

Cat. XC-0232

Was $99.95
Save $40
January $59.95

CRAZY PRICE

## High Impact Plastic Case

These originally were made for a TV game console. Ideal for digital cameras, computers etc. Buy a piece of foam, make cutouts to suit camera, lens etc., etc. Once the lid is closed, the inside diameter measures 270(L) x 400(W) x 80(D)mm. Outside dia. is 295 x 420 x 98mm Cat. HB-6330

Only $15 Save $4.95
LIMITED QUANTITY AVAILABLE

## Jaycar Platinum CDR's

NEW

These CDR's, are silver/silver, 74 minute 650mB. Great value!!

- 1 Disk $2.85 Cat XC-4715
- 10 Disks $24.50
- 100 Disks $235 Supplied in Jewel case

### Bulk Pack Not in Jewel case

- 1 Pack Cat. XC-4716 (10 Disks) $22.50
- 10 Packs (100 Disks) $210

## Wireless Indoor Outdoor Thermometer

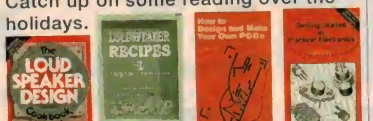
Main unit & 1 sensor supplied.

Cat. QM-7220

Cat. Price $99
Jan. $59 Save $40

## BOOK SALE

Catch up on some reading over the holidays.




BA-1400 BA-1402 BB-7023 BB-7041

Buy 1 Book, get 25% off the next Book (or Books)

## Caller ID

See or hear the phone number of the incoming call. *You need to subscribe for this service.

### LCD Display

Cat. YT-6010
Was $59.95 Save $10
Jan. $49.95

### Talking ID

Cat. YT-6000
Was $59.95
January $39.95
Save $20

## LCD DIGITAL CALIPERS

Cat. TD-2082
Cat. Price $99
Jan. $69
Save $30

## What a Flop! Emergency Multi Sizing Socket Tool

Was selling last year for $16.95. Grab one for the tool box. See 99 Cat. page 140. Cat. TH-1908

Only $5

## Digital Thermometer

Cat. QM-6320

Was $10.95
Jan. $7.95 Save $4



OVERNIGHT DELIVERY

# OVERNIGHT DELIVERY

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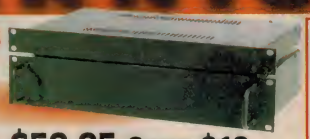
## Rack Cabinets



### 44MM Black

Cat. HB-5410

Was $69.95 Jan. $59.95 Save $10

### 88MM Black

Cat. HB-5412

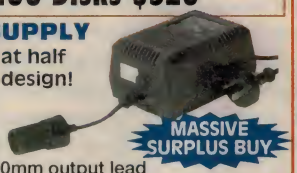
Was $87.95 Jan. $72.95 Save $12

## Mitsui Gold CDRs

Certified for use in all high speed CD-R writers, up to 8 speed. Supplied in jewel case.
Cat. XC-4709

**1 Disk $3.95**
**10 Disks $33.50 100 Disks $320**

## BARGAIN POWER SUPPLY



Switchmode technology at half the price of transformer design! A generous 4.5 amp at 13V regulated! Useful for either CB or Amateur Radio. •Case measures 130x90x70mm •100mm output lead terminated in a cigarette lighter socket. Stock is brand new but some may be slightly dusty. We don't expect these to last! Cat. MP-3071

MASSIVE SURPLUS BUY

**$79**

## 30 Piece Security Driver Set

See Catalogue page 130. Cat. TD-2001
Includes a lot of weirdo bit sets.

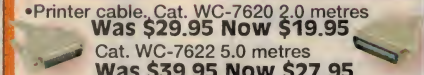
**Was $24.95 Save $9 Jan $15.95**

## Computer Leads

### LOWER PRICES ON IEEE 1284 LEADS

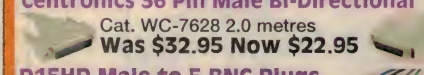
**D25 Male to 36 Pin Centronics Male**

•Printer cable. Cat. WC-7620 2.0 metres
**Was $29.95 Now $19.95**



Cat. WC-7622 5.0 metres
**Was $39.95 Now $27.95**

**D25 Male to HPCN36 Half Pitch Centronics 36 Pin Male Bi-Directional**



Cat. WC-7628 2.0 metres
**Was $32.95 Now $22.95**

**D15HD Male to 5 BNC Plugs**

•Monitor cable Cat. WC-7626 1.0m

**Was $39.95 Now $29.95**

## Ergonomic Supercrimp Tool

Buy the tool in January for $59.95, & receive free any die of your choice to suit the tool. Worth $19.95 - $22.95. See 99 Cat. page 136 for full details. Cat. TH-1950

DIE EXAMPLE

## LOWER PRICES ON CCD CAMERAS

### Board Camera with Audio
Cat. QC-3462

Was $119 Now $99 Save $20

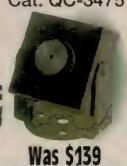
### Pinhole with Audio
Cat. QC-3463

Was $119 Now $99 Save $20

### Metal Case with Audio
Cat. QC-3474

Was $139 Now $119 Save $20

### Pinhole in Case with Audio
Cat. QC-3475



Was $139 Now $119 Save $20

### Waterproof Bullet Camera
Cat. QC-3464

NEW $169

### Colour Dome
Cat. QC-3484

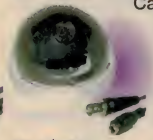


NEW $239

### Colour with Audio
Cat. QC-3483

Was $249 Now $229 Save $20

### B & W Dome
Cat. QC-3472

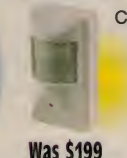


Was $129 Now $109 Save $20

### In Case with Illumination
Cat. QC-3466

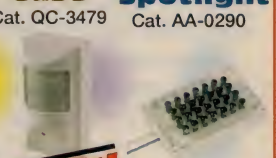
Was $139 Now $119 Save $20

### PIR CCD Camera
Cat. QC-3478



Was $199 Now $179 Save $20

### CCD in PIR Case
Cat. QC-3479



NEW $149.50

### Infra Red Spotlight
Cat. AA-0290



$45.00

Beware of low priced colour cameras that are CMOS and not CCD

## EMAIL ORDERS

mailorders@jaycar.com.au

EMAIL YOUR ORDERS NOW

## JAYCAR AUDIO LEAD MADNESS

Stock up and save.
3.5mm to 3.5mm stereo

| Cat. # | Type | |
|---|---|---|
| WA-1022 | 1.4 metres | $1.00 each |
| WA-1021 | 5.0 metres | $1.50 each |

## Bargain BNC Crimping Tool

This tool not only crimps BNC, but TNC, N, F and twinax crimp plugs also. HEX crimp three different sizes - 6.48mm, 5.4mm and 1.72mm. Use with RG58, RG59 and RG62. Cat. TH-1880

**Was $44.50 Save $15 Jan. $29.50**

## Velleman 5mhz Personal Scope

**This brand new portable oscilloscope is about the same size and price as a good multimeter.**

Its high sensitivity - down to 5mV/div - and extended scope functions make this unit ideal for hobby, service, automotive and development purposes. It's ultra fast full auto setup function, makes measuring waveforms very easy.

SOME FEATURES: •High contrast LCD with wide viewing angle •Full auto set up for volt/div and time/div •Trigger mode run - normal - once - slope -/+ •True RMS and dB measurements •Readout: Vdc - Vpp - Vrms - dBm (x1 and x10 calculation option) •Display mode: none - markers - grid - crosshair •Marker readout: dt - 1/dt (frequency) - dV •AC/DC/GND input coupling •Automatic zero reference for DC measurements •Auto power off or continuous on •Low battery detection •Includes battery charge circuit.

NEW MODEL

Only $399

**ACCESSORIES:**

| | | |
|---|---|---|
| LOGIC PROBE | Cat. QC-1902 | $37.50 |
| MAINS POWER SUPPLY | Cat. MP-3007 | $16.95 |
| ALKALINE BATTERIES 5 X AA | Cat. SB-2425 x 2 | $9.00 |

Cat. QC-1906

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Jaycar ELECTRONICS

**HEAD OFFICE**
8-10 LEEDS ST RHODES 2138
PHONE: (02) 9743 5222
FAX: (02) 9743 2066

Quality Endorsed Company ISO9002 Lic 6143 Standards Australia

**WHOLESALE**
PHONE: (02) 9743 5222
ORDERS: 1800 620 169
FAX: (02) 9743 3070
FREEFAX: 1800 810 137
MELB: 1800 731 363

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ENQUIRY HOTLINE: (02) 9743 6144 FAX: (02) 9743 2066

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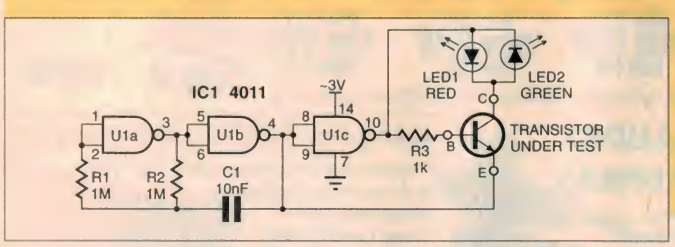
# Circuit & Design Ideas

Interesting original circuit ideas and design tips from readers. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

## Cheap and cheerful transistor tester

By using a simple visual indicating system, this small circuit allows you to make a quick good/bad check of both NPN and PNP transistors. If the transistor under test is a working NPN the red LED will flash, while the green LED will blink for a functional PNP device. However, if the transistor is shorted both LEDs will flash, and an open circuit transistor will cause the LEDs to stay off.

The low-cost circuit is based on just one quad NAND gate chip, four passive components and two LEDs. U1a and U1b together with R1, R2 and C1 form an oscillator circuit, which generates a low-frequency square wave at pin 4. This is applied to both the emitter of the transistor under test and the inverter U1c. The inverted square wave from U3 and the oscillator output then drive the test circuit (LEDs, transistor and R3) in a differential manner, so that the polarity across that part of the circuit is repeatedly swapped.




So if an NPN transistor is under test, when pin 10 is high and pin 4 low current flows though LED1 and the forward biased transistor, but no current will flow when pin 10 is low and pin 4 high, since the transistor is then reversed biased. LED1 (red) will therefore flash at the oscillator rate. As you would expect, a PNP transistor will be forward biased when pin 10 is low and pin 4 high, so current then flows through LED2 (green) in that case.

A supply rail of around 3V (two series-connected batteries) should be adequate, although this may depend on the output voltage swing and current capability of the 4011-type chip – this tends to vary between manufacturers. The fourth section of the chip (U1d) is not used here, so its inputs should be tied to the 0V rail (pin 7).

Raj Gorkhali

Kathmandu, NEPAL **$40**

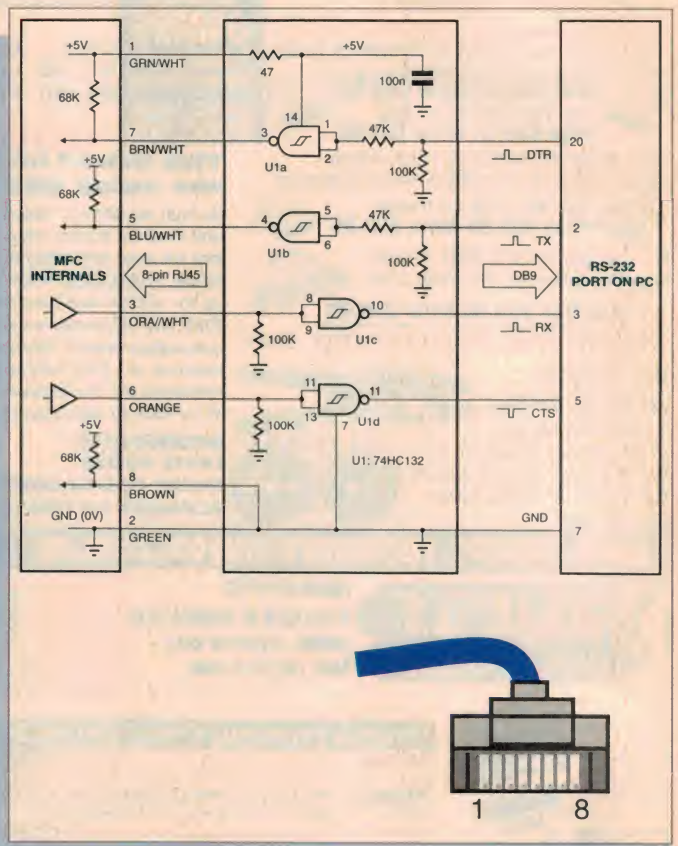
## MFC to PC interface

I recently purchased a Brother Multifunction Centre (MFC) phone/fax/answering machine to meet my small business needs, and have been quite happy with its performance. One attractive feature of the machine is its ability to communicate with your PC via Brother's 'Multi Function Link' interface, which allows you to use the MFC as a scanner, printer and a PC-controlled fax machine. Unfortunately, this proprietary interface is not included with Brother's lower-priced MFCs like mine, and follow-up inquires revealed that this would cost me close to $200 - almost what I'd paid for the MFC itself!

For me, this is like waving a red rag at a bull. Armed with an RS-232 breakout box, a null-modem cable connected to another PC, a few CMOS chips and pullup resistors, plus an older version of the MFC software I found on the Internet, I investigated how the hardware interface works. It was soon obvious that it is a serial system running at 9600bps, and the MFC port is a TTL-compatible (5V) setup with two outputs and three input lines - as shown in the diagram. After a few logical guesses and a degree of trial and error I came up with the interface circuit shown here, which may not be the same as Brother's own setup, but it works just fine.

The circuit is powered from the MFC port (pins 1 and 2), and uses just one 74HC132 quad NAND gate plus a few terminating resistors to invert and level-shift the (nominally 12V) RS-232 signals to the MFC port's 5V interface. The 47k input resistors work with the gate's built-in input protection diodes to limit the incoming voltage swing from the RS-232 port, while the remaining resistors just tie down the circuit's inputs when unplugged.

I built the circuit up on a small piece of stripboard, sacrificed a spare cat 5 network cable for the MFC end (it uses an eight-way RJ45 socket), and used a length of flat IDC cable and DB9 crimp connector for the PC end. The circuit board assembly was then squeezed into a small plastic case. As a quick check that the circuit is working, connect it between the PC and MFC, then using a comms program (say Windows HyperTeminal) send the MFC a standard modem initialising string (ATZ) - the link should be set to 9600bps in a standard N-8-1 configuration. The MFC should respond to this by sending a sensible identity message (including the word 'Brother') back to the PC.




Glen Campbell

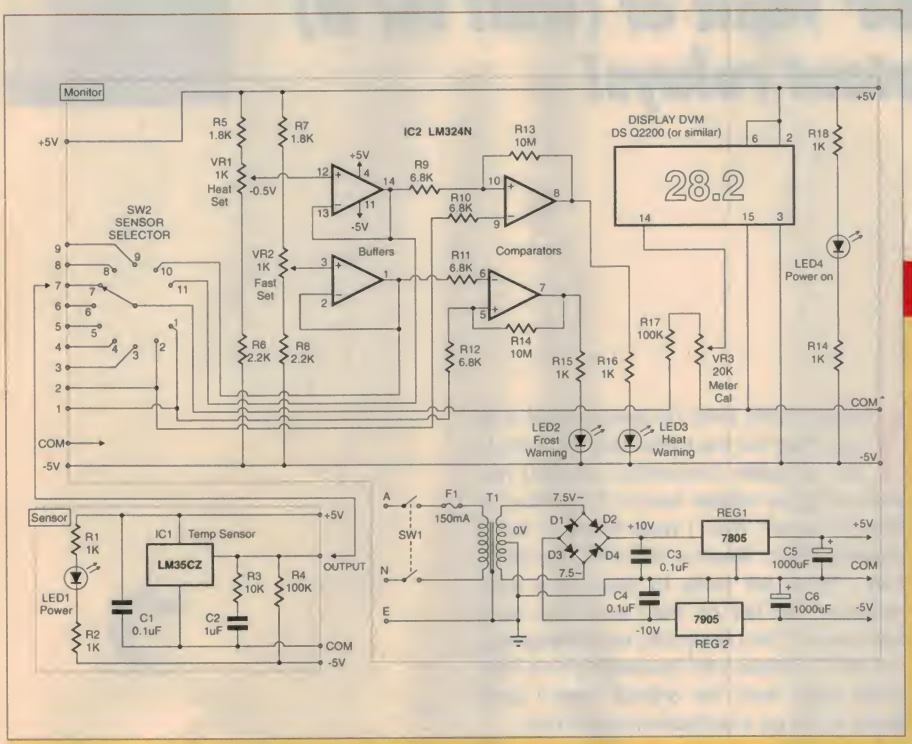
Galveston Creek, QLD **$45**

## WIN OUR 'IDEA OF THE MONTH' PRIZE!

As an added incentive for readers to contribute interesting ideas to this column, the idea we judge most interesting each month now wins its contributor an exciting prize, in addition to the usual fee. The prize is a Video Inspection Capture System from Allthings Sales & Services, which consists of a colour CCD camera, close-up lens set, adjustable stand and lamp, PCI video capture card and software, plus video cable and two plugpacks. You can find out more about this great system at the Allthings website; www.allthings.com.au.

*Valued at $469!*

Win our 'IDEA OF THE MONTH' Prize!




## Multi-point digital temperature monitor.

This circuit can be used to monitor the temperature at nine remote locations, using small sensor modules based on National Semiconductor's LM35CZ linear temperature sensor IC. Conventional thermocouples and RTDs (resistance temperature detectors) need special compensating and linearising circuits, but the LM35CZ is a linear device that generates 10 mV/°C over the range -40 to +110 °C, and is laser trimmed to give 0.0 mV at 0.0 °C. With this device only simple electronics are needed to realise accuracies of +/- 2°C or better, with careful calibration. VR3 is the only calibration, and there is no adjustment for the output of individual sensors.

There are eight components including the LM35CZ in the sensor case. C1 gives some bypass protection against radio frequency interference, while R3/C2 enhance the sensor's ability to drive into long, capacitive cable loads. R4 is included so that the sensor can supply a negative output. Although not strictly necessary, R1, R2 and LED1 give a visual indication that +/- 5V is present at the remote site – it also gives the impression that the unit is a security device!

Nine remote sensors may be connected using unscreened 4-core telephone cable, at distances of up to 100 metres or more. The LM35CZ sensor may be potted for use with liquids (boiling water), or enclosed in a ventilated shaded enclosure for air temperature measurements. Applications for the system include weather stations, house/pool/fish tank, solar heating, livestock or chook sheds, ski resorts, and electronic circuit prototype heat surveys. Warning; the equipment is **not** suitable for use in classified hazardous flammable liquid or gas applications.

The circuit incorporates two adjustable 'set' points; one for frost warning (tied to input 1) and one for heat (tied to input 2). Two simple comparator circuits compare the incoming sensor voltage with reference voltages generated by VR1 and VR2 (via their matching buffers), while LED2 and LED3 act as visual alarms. R13 and R14, both 10M, provide some hysteresis to prevent chattering.

Positions 10 and 11 on the sensor input selector switch (SW2) are used to monitor the frost and heat reference voltages (from VR1 and VR2 buffers), so their trip temperature can be read while adjusting the trimpots. The heart of the measuring circuit is a DSE Q2200 3-1/2 digit LCD digital panel meter, although Jaycar (QP-5570) and Altronics (Q0560) types might be suitable.

A prototype was built in 1993 to monitor a house before and after insulation. It has given trouble free operation for six years, and has only been recalibrated twice. For simplicity and economy, manual switch selection of sensors and recording of data was used. Another switch could be cascaded into input 9, and more alarm points added by including another LM324N quad opamp. If remote alarms are needed, this could be done by inserting low-cost optocouplers in series with LED2 and LED3, however this has not actually been tried.

D R Gott

Toowoomba, QLD **$30** ❖

## THIS MONTH'S WINNER!

# Forum

Conducted by Jim Rowe

## That 'never say die' topic of (wait for it) — motorhome cutout relays!

*Of all the topics we've discussed here in Forum over the years, the one I least expected to stir up ongoing arguments and emotion is the one that might well end up winning some kind of record for doing so: the one about cutout relays in motorhomes, and their 'true' purpose. You guessed it, I have a couple more missives about it for you this month...*

YOU'D THINK THAT I'd have at least a bit of a 'feel' for the topics that are likely to stir up reader controversy, wouldn't you, after acting as referee here in Forum for the last 12 years? Well, I have to admit that I probably don't. Most of the time the topics that *I* think are likely to produce a lively response fall flat on their proverbial face, while others that I put in with some misgivings ('oh well, perhaps a few people might be interested apart from the original writer') often seem to stir up a veritable hornet's nest.

To be honest, the topic of motorhome cutout relays and their true purpose fell very much into the latter category, when I first published a letter from UK reader Paul Coxwell in the October 1998 issue. Although a fairly esoteric subject (how many of us actually have motorhomes?), it did seem mildly interesting, and we didn't have too many other letters to run in Forum that month. So it was very much a matter of 'OK, let's run this one, and see if anyone can get stirred up apart from Mr Coxwell'.

Boy, was I wrong! First, there was an email from reader Darrin Wilson, which I published in the January '99 column, essentially accusing Mr Coxwell of 'talking through his hat'. Then after that one was published there was another one in the April issue from a reader who didn't want his name published, accusing Mr Wilson of not having *his* facts straight. For an esoteric little topic, it certainly seemed to be generating some interest — not to say emotion...

Now, as you might guess, there have been two *more* missives on the same topic: one from original writer Paul Coxwell, and the other from his first critic Darrin Wilson. Not surprisingly both are seeking the right of reply, so it seems only fair to present them both this month — and in the order of their original arrival.

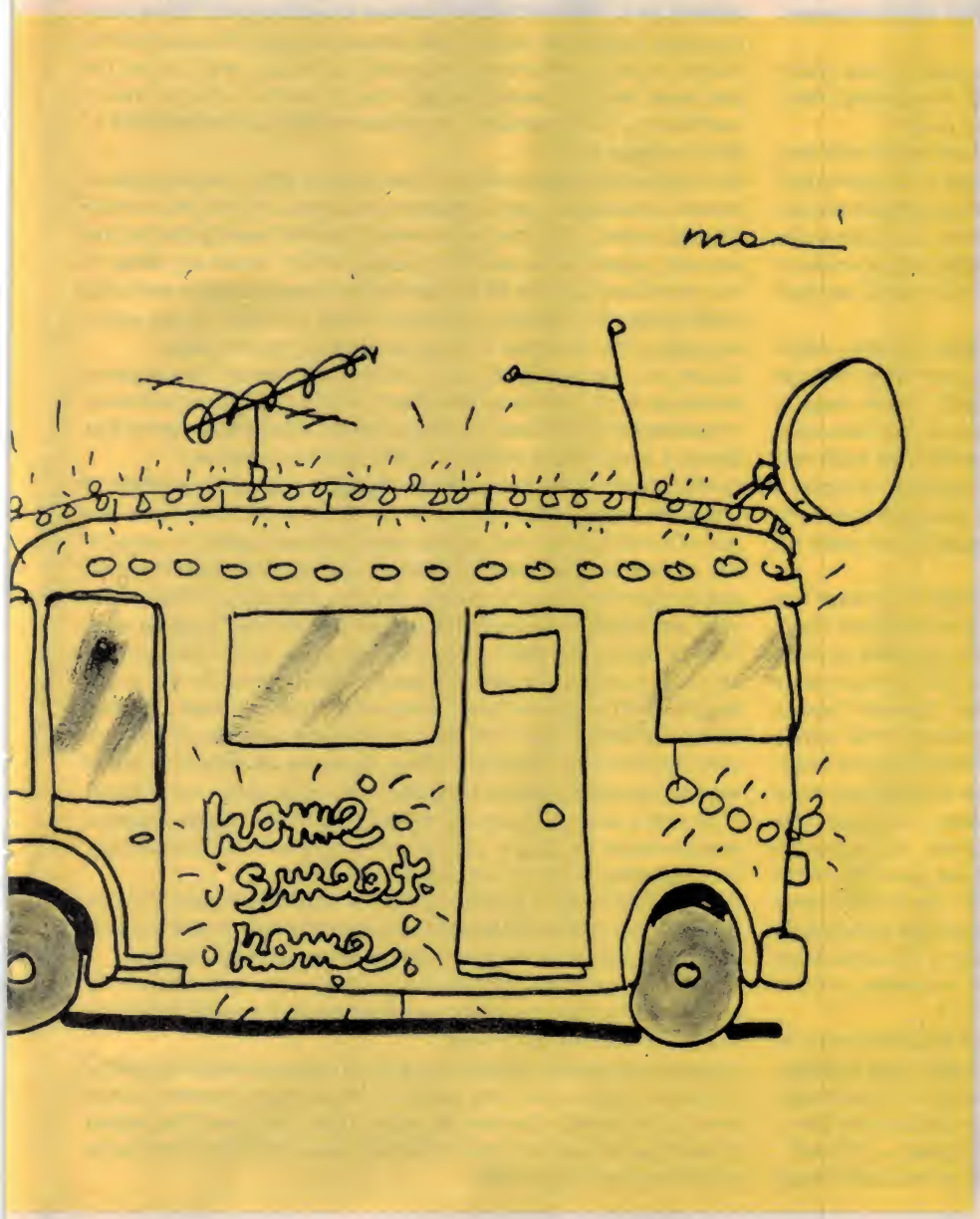
So without further preamble, here's what Mr Coxwell has to say in response to both Darrin Wilson and April's 'Mr Anonymous':

*Hello again from England. I have been meaning to write once more about EMC and motorhomes since Darrin Wilson's response (January 99) to my original letter (October 98), and have finally been prompted into action by the comments in April's Forum.*

*Mr Wilson seems to think that I had completely missed the point of the cut-off relay, suggesting that the latter was fitted to prevent interference being radiated from the vehicle. My comments were based upon the answer given by a motorhome manufacturer, and if Mr Wilson cares to re-read my letter he may realize that I was simply questioning whether that manufacturer's response was to be accepted at face value.*

*That said, I still do not accept that the relay is there to prevent the radiation of interference. If there is sufficient noise and 'hash' present to cause interference from a wire running to an interior light in the caravan section of the vehicle, it is logical to assume that it would also be radiated quite effectively from any other similar length of wire, such as that going to the tail lights. Admittedly the effects could be cumulative, but I feel that if noise can be suppressed sufficiently on wiring which has to be energized whilst travelling, then it can be suppressed sufficiently to allow use of the auxiliary equipment as well.*

*Any competent designer knows that the only really effective way to eliminate such interference is to suppress it as close to the source as possible. Ignition noise was probably a poor choice of example too, since 30 years ago there were plenty of VW 'Dormobiles' and the like travelling the highways of Britain without a trace of interference to radio and TV, and all of which had equipment in the rear which could be used whilst in motion. Incidentally, back then TV reception was far more susceptible to ignition noise than it is today. In the 1960s we were still using the 405-line system with positive vision modulation and AM sound broadcast on VHF. Today, we have negative vision modulation, FM sound, and everything is on UHF. (Whether that was a good move has been debated for many years, but that's another story!)*




*I feel that my position has been vindicated somewhat by your anonymous correspondent from Victoria, who put forward the same argument that had been used by the British motorhome manufacturer — i.e. the difference between 'CE' approval for domestic equipment and 'e' approval for automotive equipment.*

*I find myself in favour of the argument which says that some manufacturers are simply being very cautious and don't want to risk any possible come-backs by allowing the use of non 'e' approved equipment while on the move.*

*According to another item in a UK journal, new motorhomes in Australia are not allowed to have direct access between the driving cab and the caravan section. Maybe someone there can confirm whether that is true or not, but if so the loss of power to the rear section while travelling probably wouldn't be such a problem anyway, unless someone was riding permanently in the back. (It seems a strange rule if it is true, but then I've never understood why you don't allow left-hand drive cars on the road there either!)*

*I would like to take up one other point made by Mr Wilson. He states that the computerized engine controls, ABS braking systems, and so on "would be and are well protected against EMC interference." I agree that they should be well protected, but I do not believe that they always are.*

*At my previous address I lived about two miles from a ship-to-shore radio station. This handled the usual marine VHF communications at around 150 to 160MHz and a considerable amount of radio-telephone traffic on SSB in the 1.6 to 3.5MHz range. The coast road passed within about 200 yards of the latter's transmitting aerial and about 50 yards from the VHF aerials. Many of my neighbours, with their new computerized cars, had no end of problems on that stretch of road with engines cutting out, spluttering erratically, etc. I had no problems with my US-built Chrysler of 1979 vintage, that having nothing more sophisticated than an electronic ignition system.*

*A quick look through almost any recent issue of 'Radio Communication' (the journal of the Radio Society of Great Britain) reveals people having no end of problems when using two-metre amateur transmitters in their new cars, even on low power levels of 1W or less.*

*There was a somewhat more worrying case here in Britain just a short while ago, involving a road-traffic accident. As a police officer walked toward the car concerned, he used his pocket radio (UHF) to summon assistance. As he started to transmit, the car's computerized central-locking system promptly locked all the doors, making the rescue team's job much more difficult than it would otherwise have*

# Forum

*been. Had the car been on fire or in other imminent danger, the consequences could have been much worse. So for my money, the designers still have a long way to go before declaring that their computerized systems are immune to EMC problems.*

*The whole subject of 'harmonized' European standards is rapidly becoming a bureaucratic nightmare in this part of the world. In fact, different groups and even different national governments seem to place their own interpretation on the supposed standards. Let's face it — it's hard enough to get a straight answer from our own bureaucrats on national matters; putting a whole bunch of them from a dozen or more different countries together and expecting them to agree on the interpretation of some obscure technical point is asking for trouble! The CE marking of domestic equipment is a good example.*

*For various reasons, I occasionally buy American-style mains connectors, wall switches, etc. directly from US suppliers. When this came up in conversation recently, I had one American designer (concerned with building equipment to meet CE standards for Europe) tell me that he thought it was illegal to import such fittings into Europe because they don't have CE approval. Another American at Graybar Electric, one of America's largest suppliers of domestic electrical fittings, said he exported stuff to Europe all the time and never had any problems (which agrees with my own findings).*

*The British MK catalogue of domestic electrical fittings has a whole list of products which they say are subject to CE marking, either under the EMC directive or under a different 'Low-voltage Safety' directive. According to MK though, some items only require a CE mark on the outer bulk carton, not on each individual item within it. They go on to explain that plugs and wall sockets don't need a CE mark so long as they are to the appropriate British Standards. (At least that part makes sense, because nowhere else in Europe uses our type of mains plugs except for Ireland.)*

*(Continued on page 91)*

## On the other hand...

Now let's look at the latest missive from Darrin Wilson, on the same topic but mainly responding to the criticisms from our 'anonymous' April contributor:

*After reading the April Forum and the comments made by your anonymous reader (who I will refer to from now on as Mr A) regarding cutout relays in motorhomes, I feel I need to clarify a few points.*

*Firstly, since Mr A chose to remain anonymous, one must wonder what qualifies him/her to make the statements that he/she made in the letter to April Forum. I assume that they have some connection to the automotive industry, but for all I know they could be the person who tightens wheel nuts on the assembly line. It is easy to criticise someone whilst hiding behind a mask; it is another thing to stand up and put your name behind your words, and back up your words with facts.*

*I am a senior design engineer (electronics) at a reputable Australian switchmode power supply manufacturing company, who custom design for other equipment manufacturers in the commercial market. I have designed power supplies for medical equipment, gaming machines, telecommunications equipment and RF transmitters, and as the majority of the equipment that our power supplies are designed into is usually exported, we require a strong knowledge of international EMC and safety standards to sell into those markets and we make EMC emissions, susceptibility and safety the main focus in all of our designs.*

*I have been to open-air EMC test sites for EMC testing of my power supply designs, where they are tested in the customer's equipment. These test sites test anything and everything that has the possibility of creating electromagnetic interference. They also perform EMC emission tests on as-yet unreleased new vehicles; the procedure basically involves starting the engine and operating every electrical device in the vehicle while the level of emissions are measured over a broad frequency range. This type of testing is much the same for any type of equipment capable of causing electromagnetic interference, whether it is a power supply or an automobile. Mr A writes about susceptibility, but it appears that he/she has totally neglected to acknowledge the possibility of EMI emissions as well. I will be the first to admit that I am not fully aware of all the detailed implications regarding the automotive standards in this area, but I have done enough work in this field to know that basic common sense still applies regardless of the item in question, and the basic testing is still the same.*

*Mr A also writes about the severe testing that 12V equipment must be designed to survive, and then about the use of a cutout relay to protect the equipment from such environments. These comments are contradictory, because if it is designed to survive this sort of testing then there is no reason for a cutout relay for protection in the first place — is there?*

*To give your readers some idea of the testing we do on new power supply designs, as part of the design phase we conduct a number of tests to particular IEC standards. We have equipment that is capable of applying lightning surges directly onto the mains AC input, and other equipment for applying up to 20kV ESD hits on external accessible parts. Some tests can cause catastrophic failure, while others may cause the equipment to 'hiccup'. In any case the end product must not 'hiccup', and if it does fail (only under the most severe testing) it must fail safely — i.e., no fires or electrocution. Sounds similar to the automotive testing described by Mr A, but on a bigger scale.*

*Mr A makes the comment that if I have read his letter, I would suddenly become knowledgable and understand his reasons why he/she believes the cutout switch was fitted to the motorhome. Well nothing that he/she has said, except for the part about severe testing, makes any sense to me, mainly because after Mr A's spiel he/she failed to explain why some motorhomes had switches and others didn't — which, to my understanding, is the whole basis of this discussion in the first place.*

*So why is it that supposedly some manufacturers protect their sensitive electronics with a cutout relay and others don't? And if someone who doesn't understand the implications of bypassing the relay decides they want to bypass it, what happens then with all that sensitive electronics?*

*I can't believe that any reputable manufacturer would put the reliability of their safety-critical components in the hands of a simple relay. What happens if the relay simply fails, with its contacts fused together? In my book this sounds like poor design practices. You can't fully protect people against their own stupidity, but you can go a long way to minimise the risks; and designing the protection inot the module itself is a good start.*

*The final issue, which again makes even less sense, is the statement that Mr A makes about a 'rule' that if equipment can be operated in the mobile home it must be approved to the 'stricter automotive standards'. We have already established that there must be adequate protection for the vehicle's electronics from interference from the device, as there is no way of stopping the equipment from being used in the motorhome — cutout relay or no cutout relay, the owner will still bypass it if they choose. Therefore maybe what Mr A is trying to say is that the equipment itself must be capable of operating in a noisy automotive environment.*

*So what is the issue? It will either operate or it won't. Either way, if it's not designed to be used in that type of environment then it is the user's responsibility. The main thing, though, is that everything else keeps working.*

Thanks for your further comments too, Mr Wilson. Our correspondent 'Mr A' does seem to have 'got up your nose', but hopefully you'll be happy now that you've had a chance to reply.

I suppose it's almost inevitable now that our April contributor will want to make some further comments, and if they do so desire I'll have to publish them out of fairness. But apart from that, I think we'll leave this subject to cool down for a while at least. There's so many interesting other topics to talk about, don't you think?

# SERVICEMAN

***This month we begin with a couple of notes from readers about recent items in this column, and then we look at the repair of not one, but two inverters based on an EA design.***

The first item is a letter from Frank Di Bartolo (via e-mail) and he comments on the IR remote control story in the June Serviceman.

In his short note, Frank does not tell us much about his background. But you will see that he has a lot of experience with IR remote controls, and plenty of opportunities to see the mayhem generated by compact fluoros. Here's what Frank has to say....

*The problem of remote controls only working in the daytime has long been a frustrating problem. I have come across this misbehaviour on many occasions.*

*Members of CEDIA (Custom Electronics Designer & Installer Association) use IR (infrared) receivers and repeaters to control equipment that may be hidden away in cabinets etc. and those compact fluoro lights have been known to lock-up the remote receivers with a constant stream of IR noise. Of course this noise is faithfully duplicated by our repeaters and hence we are unable to control the equipment as the repeaters saturate the equipment's own receivers, causing a total lock-up of the IR functions, as described in The Serviceman's story.*

*Sometimes, however, this can cause intermittent problems such as "the volume goes up or down on it's own" on products like CTV's etc. Fortunately, there are professional receiver/repeater combinations with a "flash-back led" that can show that a problem exists.*

*For around $220 (trade price) a simple combination IR receiver/transmitter and power supply will graphically demonstrate that this is a problem in the home or office. Our instore tests show that not all compact fluoros generate the problem to the same degree. But the worst ones can affect equipment that is 20 feet or more away and the 'noise' can bounce off walls etc.*

*CEDIA conducts training classes to improve the knowledge and standards of its members. It was at one of these classes, about 5 years ago, that I learned to avoid compact fluoros wherever we intended to use IR equipment.*

Thanks for those comments Frank. When I wrote the June story, I was unaware that compact fluoros were capable of creating so much trouble. However, since then several readers have written or rung me to put me straight.

As Frank mentions, some lamps are more troublesome than others so if you want to use compact fluoros in a room where IR controls are in use, try several brands and several types of lamps. You should find one that works, but in the event that none do, either change back to ordinary incandescent lamps or get yourself a long arm that can reach the TV from your easy chair!

## Fatal design

The second e-mailed comment comes from Rex Newsome and concerns a story by Peter Lankshear in the August column. Rex mentions a potentially fatal design that is and always has been a particularly popular arrangement for high powered equipment.

We don't know how many people have been killed by a simple failure in this system. But telling about it now might help to save many in future. Here's what Rex has to say....

*The story by Peter Lankshear (EA, August 99) reminded me of a real nasty that bears constant repetition.*

*It has been a practice by amateur radio enthusiasts to build high power linear amplifiers. Many of these are beautifully made, with a separate power supply that provides up to 1500V to a single or pair of large valves in the amplifier cabinet, via a cable and a suitable plug.*

*As the filament current for such bottles can be some amps, often the filament transformer is mounted on the amplifier chassis and fed with a separate mains connection. Such a setup is a nasty trap ready to spring, for, apart from coax connectors, the operator's safety relies on a single earth-return via the pins on the power connector. Imagine that the amplifier stops working because, unknown to the user, the earth-return pin becomes faulty, or the wire connection comes adrift.*

*Our user, suspecting a faulty input connection, will start unscrewing the coax plugs and whatever while the power-supply remains on. Since the final tubes are still lit, and have up to 1500V on the plates and will be in a condition ready to conduct, our user can find himself shaking hands with a very large voltage as he now provides the earth return.*

*I found out about this through hearing of the departure from this life of a local technician who happened to touch the console of a commercial transmitter that had developed a faulty earth return to the power supply.*

**We don't know how many people have been killed by a simple failure in this system. But telling about it now might help to save many in future**

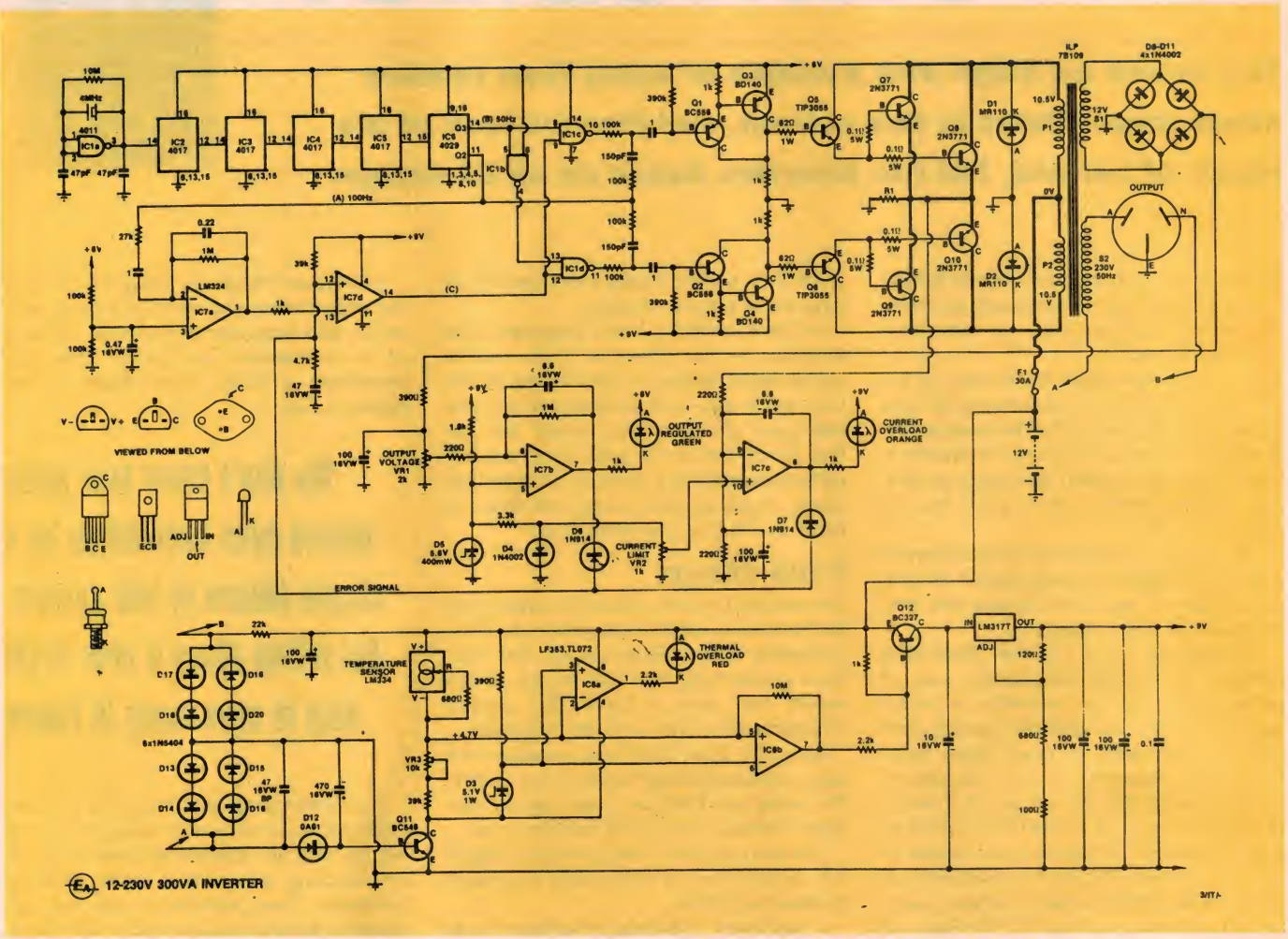
*It occurred to me that the same problem could easily occur to ham equipment (or to any hifi amp with a separate power supply!). On checking the current ARRL Amateur Handbook, I was horrified to see full construction details of a power amp, with separate power supply and an isolated filament transformer. The system relied totally on a single negative return — apart, that is, from whatever incidental returns may be provided by input and output plugs.*

Thanks for that story, Rex. It's a salutary warning about an unheralded danger in a form of construction popular since the very early days of electronics. As you point out, even professional transmitters are not immune to the danger. I can recall a professionally built announcer's desk that boasted a spider's web of earth links and shields around the preamps and faders, and just a single earth return to the power supply some distance away in the control rack.

I guess that the danger is somewhat less these days, with the lower voltages required by solid state electronics. Just the same, some high power audio amps have dangerous, if not fatal, voltages on the output transistors. And they are built with separate or remote power supplies.

I suppose the only answer is to be aware of the danger, and as Peter Lankshear said in his story, switch off before working on split supply systems.

# SERVICEMAN




## More inverters?

Now for an item from a frequent contributor. The item arrived in a letter which began *"...I thought you may like to hear another story about inverters from down south here".*

If I had been asked directly I might have said "No thanks!" We seem to have had more than enough inverter stories lately. But as I read on I realised that the story might be of interest to a lot of readers, not least those who have built up inverters from designs presented in this magazine.

The story comes from Peter Laughton, of Albion Park in N.S.W. Peter has contributed several stories about remote area power supplies in recent months and I don't think the subject is at all out of place here. I have an early model inverter that originally supplied power for an outdoor recording 'studio' and later sat under the bench as an emergency AC supply in my workshop. In that mode it only rarely got a run, but when it did it was usually invaluable.

So inverters are very useful devices, and the more we know about them, the more we can keep them up and running. etc. etc. And all of that was just to introduce Peter Laughton's latest contribution on the subject. Here's what he has to say...

*The phone rang and a long standing customer started telling me his tale of woe, about the damage that former tenants had done to his Bush House. Whilst he was rambling on, I had a quick think about the power system and possible damage that may have happened because of the abuse.*

*The system consists of a 400 amp-hour 12 volt battery, two 50 watt solar panels, a 3.5kVA petrol generator and a box containing a 50 amp battery charger, metering etc. A 300 watt inverter based on the EA design from the early 1980's is also installed. All in all, it's a pretty typical solar installation for lights etc. in a small house.*

*I mentally crossed the inverter from the list as it has a 30 amp circuit breaker and the design has been upgraded with 4 sets of output transistors and a cooling fan. But I had made a wrong assumption... Apparently, the tenants had been operating a washing machine from the inverter and were complaining that it hadn't worked for some months!*

*I suggested he bring the inverter over and I would have a look, with a warning that if the output transistors or transformer was damaged, then repair would not be economical.*

*A close visual inspection revealed nothing burnt, so it was connected to the power supply with the current limit set to 1 amp or so. All that happened was a squeak when switched on. The next step was to check that there was voltage on the IC divider chain. This unit had been modified to include a small regulator and a different voltage feedback arrangement to give a better RMS voltage than the original resistor and capacitor, especially on light loads.*

*All the voltages seemed OK so it was time to check for the presence of 50Hz at the output of IC6. But there was no 50Hz. A check of IC1 showed that the crystal wasn't operating. All the ICs are in sockets, so it was easy to change it.*

*This got the crystal operating, but at 8MHz, not 4. The malfunction was found to be caused by the 47pF capacitor on pin 1. It was low (less than 10pF), so it was replaced with a 68 pF unit.*

*At the rest of the divider we had 400Hz, 40Hz, 4Hz, but still no 50Hz. IC6 was dead. Changing it brought the inverter to life, but the output voltage was over 320V rms and adjusting VRI (the Set Output) didn't change anything. IC7 was then changed and the voltage dropped to 232 volts RMS. A 100 watt load was placed on the output and the voltage adjusted to 240V RMS. (Aren't the new generation of true RMS digital meters great?) SCR1 in the thermal overload section had been disconnected by somebody else, but in view of the enormous heatsink fitted and the extra output transistors it was considered not necessary to reconnect it.*

*There are several dozen of these units operating in our area, so it seems testament to the original design that it has lasted so long. The second inverter came from another farm that uses nickel-iron batteries of some 700 amp-hours at 12 volts. This system has 24 x 30 watt solar panels, a 7.5kVA Lister diesel generator and a 120 amp battery charger. The design of the inverter is almost the same as the first one, with the exception of auto start and a regulator fitted as standard. Once again, a close visual check was given and we found Q5's plastic package was cracked. It still tested OK, but was replaced anyway. (It is sometimes amazing how much damage a semiconductor can withstand, yet still work.)*

*Q6 was checked and was also dead. The 390 ohm resistor in the voltage feedback path was burnt. It still read 393 ohms but was changed as well. The output transistors were disconnected from the drivers to enable testing of the main board without any high voltages appearing on the transformer. Time for the smoke test.*

*Once again the current limited power supply was connected up and the inverter wired to operate continuously. But there was no output. A check of the voltages on the ICs showed 0.6 volt less that the power supply voltage. This looked as though the 9 volt regulator was shorted but this wouldn't stop the unit from operating. I made a mental note to replace it later.*

*The power supply was turned up to 10 volts, and I noted that the current draw was 46mA. Again, a check of the frequency divider showed IC2 was dead. Once more, sockets made the repair easy, the supply current dropped to 30mA and we now had the appropriate frequencies on the driver transistors. It was time to reconnect the output stage and... It fired up.*

*I replaced the voltage regulator with a 10 volt one as I didn't have the adjustable one specified. But when I reconnected the auto start circuit, it didn't work. IC8 was not putting out the appropriate signals. It was replaced and then all functioned OK.*

*The output voltage was adjusted to 240 volts at 100 watts load. The thermal overload was tested by switching the dummy load to 1kW and waiting for 30 seconds or so. When everything worked OK, I was able to pronounce the inverter fixed.*

There now! That didn't sound too difficult, did it? Certainly not as difficult as colour sync or drum servo problems. As I mentioned, inverters are an essential part of remote area power supplies. And they can also be a valuable standby in other places too. And as Peter Laughton shows, they are not all that difficult to repair.

Thanks for that story Peter. It's a useful reminder, to those of us who get unlimited power at the flick of a switch, that others are not so fortunate. But no more inverter stories for a while, eh!

That brings us to the end of this month's column but before I go, I'd like to make a request of intending contributors. Please make sure your name AND postal address are included with the copy. With the increasing popularity of e-mail, some contributors are submitting their material electronically. And since every e-mail message automatically includes a return e-mail address, senders usually forget to add a postal address as well.

Any contribution, apart from short 'Letters to the Editor', will earn the writer a publication fee. Unfortunately, we don't have facilities to send cheques by e-mail so forgetful writers might miss out. Don't let it happen to you! ❖

***By chance we picked up a copy of the April 1939 edition of Radio and Hobbies (the first issue of R&H!) and on page 37 we found a photo of a 50 watt ham transmitter that clearly illustrates the danger discussed in this month's column.***

# COMPUTER CLINIC

## A look at Windows NT, and what it offers the home user.

For the last few months, I've been using Windows NT almost exclusively - it's the OS installed at work, and I've got it on my personal machine now as well. While there are some annoying limitations with NT, it's an awful lot more stable, not so bloated, and has quite a lot going for it. This month, I thought I'd take a look at the differences between NT and 9x — if you're sick of the tackiness of 9x, NT will do you a lot of good.

NT4 has always been marketed as the OS for the corporate desktop — mere home users are generally expected to use Windows 98 instead. In some ways, this isn't a bad idea; 98 has a lot more hardware and multimedia support, and the tools and utilities included are a lot friendlier if you're new to computers. NT is a lot more powerful, though, and if you get annoyed by the tacky, buggy mess that is Windows 98, you may quickly grow addicted to it.

There are some things you have to give up, though, and this can take a little getting used to. A lot of these features will be added in Windows 2000, but it'll be expensive, resource-hungry, and a while yet. In the meantime, NT4 is still an extremely professional, rock-solid OS, and worth taking a look at.

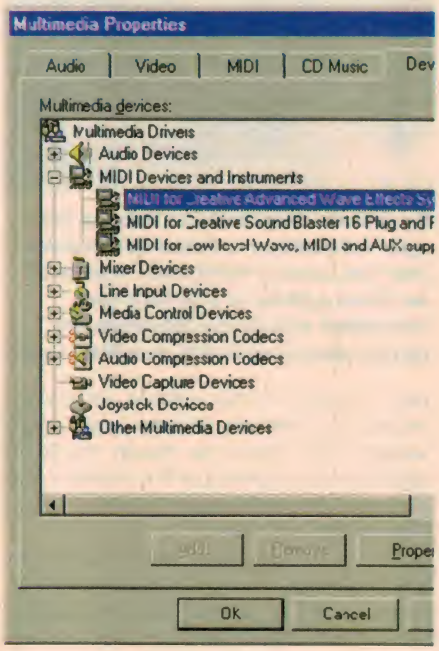
## What you don't get

But first, the bad news... NT isn't Win9x, and there are a few things you don't get, including:

**USB support:** This will be coming in Windows 2000, but as it stands, it just can't be done. Of course, if you don't have any USB peripherals, then it doesn't matter

**DirectX 4+**: This is a bit annoying; if you're into video games and fancy multimedia apps, then you might have a problem. NT does support DirectX 3 though, so older or less-picky games will still work.

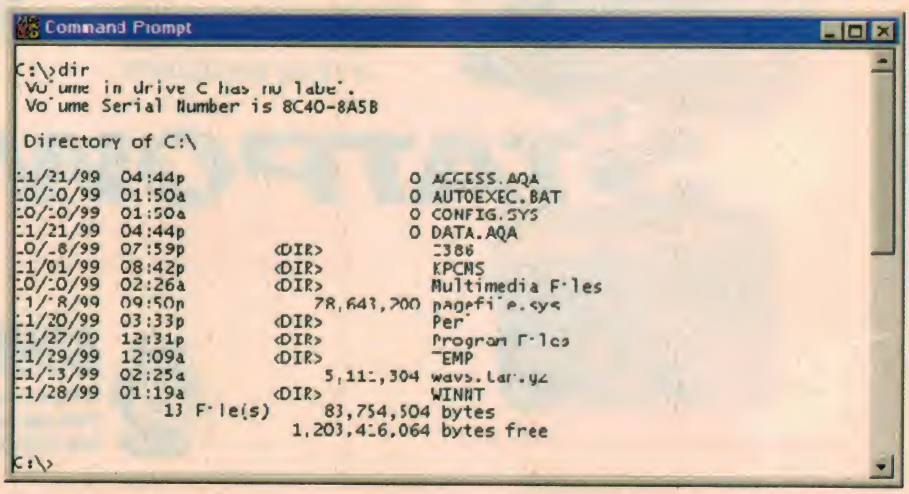
*Direct hardware access*: This is, of course, a major part of NT's stability, but it can indeed be a pain Pretty much all @BODYTEXT:Windows apps are going to run, but old DOS programs can have problems - if they try to talk to the hardware directly (such as directly hacking the VGA card or the parallel port without using the approved methods), they'll simply die. There's a fairly high attrition rate, about 25% of DOS apps and games won't run, but there's nothing I've really missed. (Apart from my C64 emulator, that is)




**Device Manager:** The first resort of 9x users, Device manager keeps all the device info in one place, allowing you to remove, view and edit settings for all your hardware devices. NT doesn't have this, so you have to chase up the appropriate driver entry in Control Panel, and do it from there. It's a long way round a short corner, and something due to get fixed in Win2K. There's no Add/remove hardware wizard, either, so once again, you're down to doing it all manually.

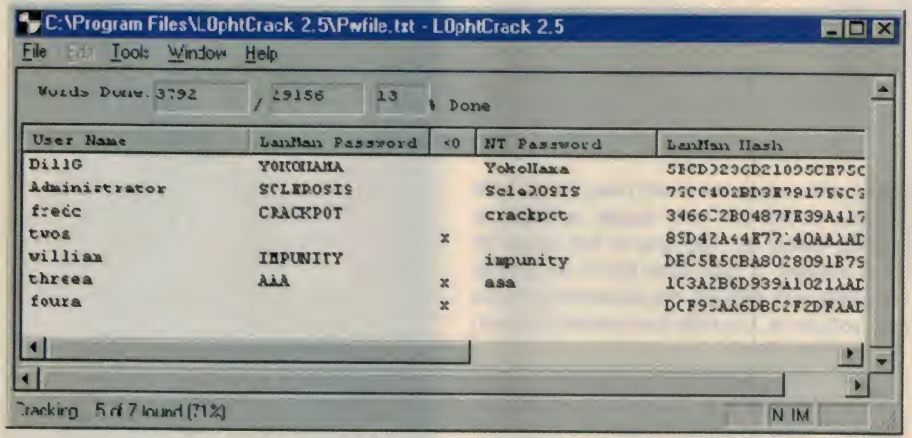
**DOS mode:** That's right, there's no way out of the GUI, so if there's something that won't run under Windows, then tough.

NT really does play for keeps, but trust me, the advantages are there. Also, there's no way to sys a floppy, or 'Create startup disk', either. You *can* create the installation boot floppies, which give you access to the Repair menu, but if you want a boot disk for another machine, you're out of luck.(You can keep all the files from a DOS boot floppy on your hard drive, and copy them across manually, but it's slow, messy, and doesn't write the boot sector.) Luckily, there's a way round it, in the form of rawread **(http://src.doc.ic.ac.uk/Mirrors/ftp.suse.com/pub/loadlin/rawread.exe) and rawrite (ftp://ftp.redhat.com/redhat/redhat-6.1/i386/dosutils/rawrite.exe)**. These handy little utilities allow you to save and restore image files of floppy disks, rather like a scaled-down version of Norton Ghost. Simply grab an image file of a useful boot disk , and next time you need one, reinflate it back onto floppy. You can keep a collection of your favourite configurations ready to go — it really is useful, and it's free, too. Some people have reported problems with the rawrite.exe under NT, so if this happens, try rawritewin **(http://uranus.it.swin.edu.au/~jn/linux/rawwrite.htm)** instead. This works just fine on 9x as well, so if you have a custom boot floppy you want to have round the place, rawrite is the tool for the job.



# by Jean-Baptiste Cattley

***Got any computer queries? Whatever is bugging you, from hardware problems to C programming, send it in and we'll soon have you fixed up. You can email your question to electaus@fpc.com.au, or fax or mail it in to us here at EA.***




***This month's software pick is Startup Control Panel, a nifty little utility that lets you see exactly what programs your computer runs at start-up, and allows you to edit, delete and add programs to the list. There are a number of places startup entries can go in a Windows system, and tracking them down manually can be a pain — but with Startup Control Panel, you can see exactly what's going on.***

***A fine little program, one that should have been made part of Windows itself. Pick yourself up a copy at http://www.mlin.net/StartupCPL.shtml. It's free, of course.***

## The good news

Right, now, after all that doom and gloom, let's look at all the neat stuff you DO get.

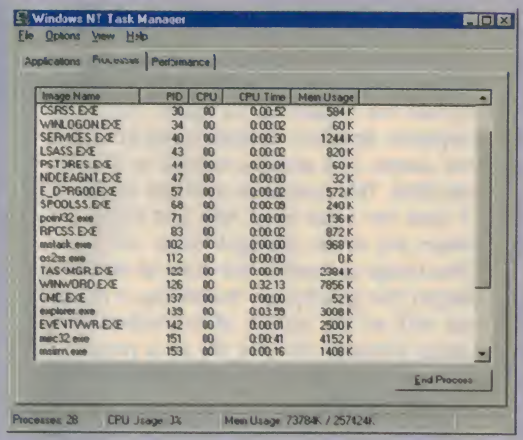
First up, stability — NT is almost impossible to kill. In over a year dealing with it, I think I've seen two bluescreens and half a dozen application crashes — you'd be lucky to average that in a week using 9x. At time of writing, my file/NAT server has been up for about six weeks, and the last shutdown was due to a blackout; it's only had one fatal crash in its existence. NTFS is also a lot less prone to corruption in the event of power failures and the like, so even that eventuality has been taken care of.

The Task manager has been given a lot more teeth, as well — if you kill a task, it dies first time - and the system stays usable.

Of course, if you really miss the old bluescreens, you can get a really evil screensaver from **http://www.sysinternals.com/bluescrn.htm** that accurately simulates all sorts of fatal errors and boot failures... It really is a scary sight. Just install it on someone else's machine, then sit back and watch them panic.

Secondly, security. NT requires you to logon before you can use it, and without the password, there's no way in, unlike 9x, which is virtually impossible to protect. (there are third-party programs for 9x that you can use, but they're none of them unbeatable) Also, with the NTFS filesystem, you can decide exactly which users can read or write your files — and the only way round that would be to remove the HD, and put it in another running NT machine.

What's more, the security subsystems prevent anyone but the administrator from making significant changes to your system — so you can't break anything unless you really want to. This is especially handy if you have children or curious but inept people using your machine...




Also, no program can run with higher privileges than the user who started it — so viruses and trojans just can't get a foot in the door — unless you habitually log in as administrator, which is foolish in the extreme. Of course, if you lose the administrator password, you really are in a bit of a state, although there are ways around it. One handy way to regain access to your system is to run l0pthcrack, a password auditing (read 'cracking') program, available from **http://www.l0pht.com**. It won't get you out of every situation, as you need a copy of the SAM (Security Accounts Manager) database to start with, or admin access to another box on the network so you can capture authentication packets as they get sent down the line. It can crack any password at all, though, all it needs is time.

There are other nice touches, too — the lack of Plug and Play is actually extremely handy if you want to use your drive in another machine, to try and track down a hardware problem, for instance. Try doing it with a 9x box, and it will go crazy on boot, detecting devices all over the place, and making your system a horrible mess.

NT on the other hand blissfully ignores any hardware it sees, unless you specifically tell it to install it. Not so handy when you add a new device, but a lot more professional all the same. If you really need PnP support for cards that won't work any other way, you can install a rather basic form of PnP using PNPISA.INF, kept in the \drvlib\pnpisa\x86 directory on your NT CD. Right-click it and hit 'install', but be warned, it'll only ask once for settings for each device, so have details handy at the next boot.

## NT for me

All up, NT is stable, secure, straightforward, dependable and professional, but somewhat boring. If you're using your computer mainly for office or productivity purposes, then it's the way to go.

If you need to be on the bleeding edge of technology, and want an all-singing, all-dancing system that does everything for you, stick with Windows 98, or wait for Windows 2000. Be warned, though, that the hardware requirements for Win2k are pretty stiff, and it's not going to be cheap, either. ❖

# $10 WONDERS

## 31 Simple siren

This project illustrates the use of three basic circuits, which can be combined with one another and with other circuits in a variety of ways. We show how to build the basic units into a warning device that sounds whenever the temperature exceeds a pre-set level. The siren circuits on their own can be used to produce various kinds of sound output and used as a door alert, a general warning signal or for sending coded messages. You should be able to find plenty of ways of adapting and using this versatile Ten Dollar Wonder.

### How it works

Fig.1 shows the basic oscillator circuit. It consists of two CMOS inverters, A and B. They are connected so that the output of A goes directly to the input of B but the output of B is connected to the input of A through a capacitor Ct. This adds an element of timing to the circuit, as does the timing resistor Rt.

The practical circuits (Fig.2) include a second resistor between the capacitor and the input to A. This resistor serves to make the circuit produce reasonably square waves, but it doesn't have any relevance to the oscillating action and we shall not describe its action in more detail.

The outputs of the two gates are always in antiphase to each other. That is to say, when output A is high, output B is low, and *vice-versa*. The other voltage level we are concerned with is that at point X, which is the voltage at the input to A. Suppose that the output of A has just gone high (say, 6V). This makes the input of B high also, causing its output to go low (0V). Just as this happens, the voltage at X will have fallen from slightly above 3V (half supply voltage) to slightly below 3V. The drop in the output of B is sudden; it falls from 6V to 0V almost instantly and, through the capacitor it forces the voltage at X to drop by an equal amount, from 3V to -3V.

The resistor now has 6V at one end and -3V at the other, a total of 9V across it. Current flows through it from the output of A, gradually charging the capacitor. The voltage at X rises from -3V at a rate depending on the values of the resistor and the capacitor, until it reaches the gate's switchover point (+3V) once again. As soon as the voltage exceeds 3V this is taken to be a high input to gate A. Its output goes low, and the output of B goes high.

This sudden increase of 6V in the output of B causes the voltage at X to rise by an equal amount, from 3V to 9V. The voltage across the resistor is 9V again, but in the opposite direction. Current flows from X to the output of A and the voltage at X gradually falls. This continues until the voltage at X (and the input of A) falls just below 3V, when the circuit changes state yet again, This brings us back to the state at which we began this description. Everything is repeated and so the output of the circuit alternates between 0V and 6V at a frequency depending on the values of the timing resistor and capacitor.

Output from the circuit is fed to the piezo transducer using a push-pull arrangement, as seen in Fig.2. As the output from one gate swings from 0V to 6V, the other gate swings from 6V to 0V, so there is a 12V reversal of voltage across the piezo which produces a loud sound.

The circuit in Fig.1 is built from inverters but we may substitute the logical equivalent, such as a NAND or NOR gate with its input terminals connected together. In Fig.1 we use two-input NAND gates. The advantage of this is that it we can use one of them to switch the oscillator on and off. In this circuit, gate IC1a has one of its inputs (pin 1) used for control. When the control is held at logic low, the output of the gate is high, regardless of the state of the other

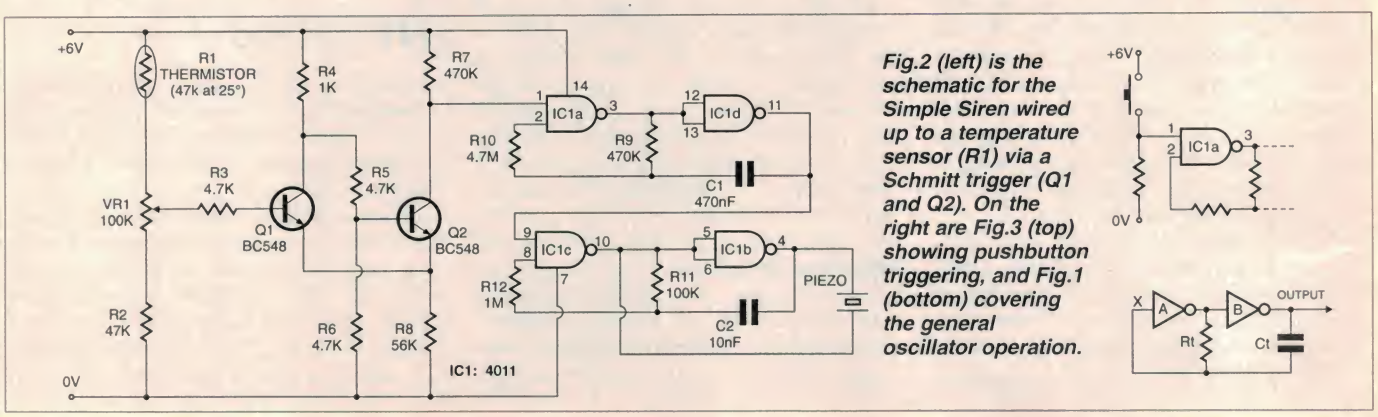
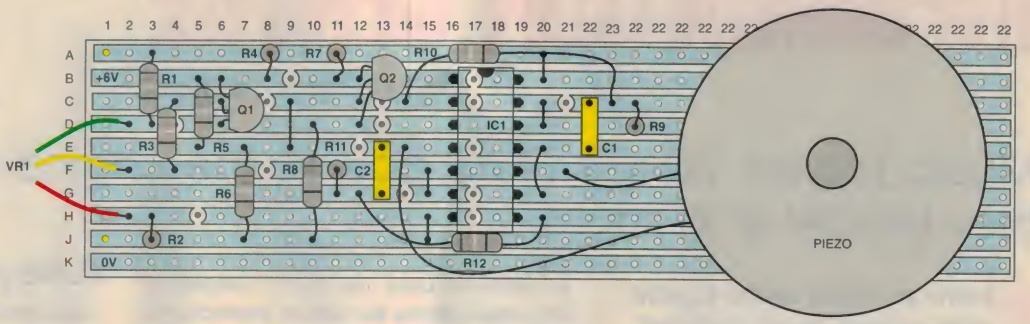



*Fig.2 (left) is the schematic for the Simple Siren wired up to a temperature sensor (R1) via a Schmitt trigger (Q1 and Q2). On the right are Fig.3 (top) showing pushbutton triggering, and Fig.1 (bottom) covering the general oscillator operation.*




***When constructing the Simple Siren, be sure to cut the tracks under R3 (hole D4) and Q1 (hole C8). Also note that R1 is a thermistor, not a standard resistor as shown.***

input. When the control is held at logic high, however, the output of the gate is the inverse of the other input.

In other words, it behaves as an inverter. You can switch this section of thee circuit on or off manually using a push-button as in Fig.3. Normally a pull-down resistor holds the control input low, but pressing the button produces a high on the input and the circuit oscillates. This arrangement can be used with a single oscillator circuit functioning as a door alert.

In this project we use logical levels for controlling the two oscillator circuits. The timing capacitor and resistor values of the audio oscillator are chosen to give a frequency of a few hundred hertz. Use the formula **f = 1/2.2 x Rt x Ct**. If the pulse-squaring resistor is included, as here, it takes a value about ten times that of Rt.

A second, 'pulsing' oscillator is used to turn the audio oscillator on and off. Its output goes directly to the control input of the audio oscillator (pin 9). Now we have an intermittent 'bleep-bleep-bleep' sound, the bleep rate depending on the capacitor and resistor values of the pulsing oscillator IC1c and IC1d. As before, the control input to the pulsing oscillator could be a push-button or it could be some other kind of switch such as a window or door switch or a pressure pad under the carpet.

With this project we decided to control the pulsing oscillator by using a thermistor. This is a heat sensitive device that acts as a variable resistor. Around normal room temperatures its resistance is in the region of 47k, but its resistance decreases with increasing temperature. The thermistor is wired as part of a potential divider with a resistor of equal value in the lower arm (the 47k resistor, R2).

Between the resistors is a variable resistor with which we can adjust the exact voltage output obtained at any given temperature. If the wiper of this were connected to the control input of the pulsing oscillator we could set VR1 so that the control input was just below 3V and the oscillator would be off. A rise in temperature would reduce the resistance of the thermistor, and the control voltage would rise and trigger the siren.

This arrangement is too simple to be satisfactory. Temperatures often change very slowly, and may hover around a given value for minutes on end. The result would be that the siren would sound in an erratic and irritating way instead of emitting a clear signal.

The solution is to use a circuit element known as a *Schmitt Trigger*.

In Fig.2 the trigger comprises the two transistors Q1 and Q2 together with their associated resistors. If the input to the base of Q1 is low, Q1 is off, and its collector voltage is close to 6V. This turns on Q2 so that current flows through its collector resistor, producing a low voltage at the collector. The output of the trigger is low and the siren is off.

To turn the trigger on we have to raise the voltage at the base of Q1 so as to turn Q1 on. This voltage needs to be 0.6V plus the voltage at its emitter. Because Q2 is on and a current is flowing through the shared emitter resistor R8, we need several volts to turn Q1 on.

However, once Q1 is on, the voltage at its collector drops close to zero and causes Q2 to turn off. Current no longer flows through its collector resistor so the output to the oscillator is close to 6V and the siren sounds. The trigger is now is its ON state. Note that its output switches sharply between 'close to 0V' and 'close to 6V'.

It is a strong positive action that turns the oscillator firmly on or off. But there is more than this. When Q2 is on, current flows through the emitter resistor, generating several volts across it. When Q1 is on the current is much smaller because of the different collector resistor values of the two transistors. So once Q1 turns on, its emitter voltage drops by several volts. Now its base voltage must be lowered considerably to turn it off again and reverse the output of the trigger.

The result is that when the input voltage is rising, the siren is turned on at a relatively high *upper threshold*. Once on, it is not turned off until the voltage has fallen to the *lower threshold* level. Small drops in voltage have no effect because there are several volts difference between the two thresholds. In this way the action of this circuit is clear-cut, no matter how slowly the temperature changes and how uncertainly it hovers on the way.

## Construction

The circuit can be built on a single board as shown (Fig.4) or certain elements such as the thermistor, VR1 and the piezo-sounder may be mounted off-board. To obtain maximum volume, it is essential to mount the sounder firmly on a rigid panel of some kind, such as on the side of the enclosure. Note that there are two kinds of piezo devices. Some have built-in circuitry to produce bleeps, warbles and other sounds. We are using the other sort in this project, which is cheaper and needs to have a circuit to drive it.

The voltage of the power supply is given as 6V, but the circuit requires very little power when not sounding so can be run on a 9V PP3-type battery. It can also be run on a 12V supply, perhaps from a mains adapter. (An unregulated supply is fine, but it must be DC.)

Construct the audio oscillator circuit first and wire it to the piezo sounder (perhaps temporarily.) Taking the control input high should cause the siren to emit a continuous sound. If you want to raise or lower the pitch alter the value of R11 or C2. Then build the pulsing oscillator and wire its output to the control input of the audio oscillator. A positive level at the control input of the oscillator should now produce an intermittent tone. You can adjust the pulse-rate by altering the value of R9 or C1. Finally construct the thermistor circuit and Schmitt Trigger. ❖

## Parts List

### *Resistors (5%, 1/4 watt)*

| | |
|---|---|
| R1 | Disc thermistor, 47 k( at 25(C |
| R2 | 47k |
| R3,5,6 | 4.7k |
| R4 | 1k |
| R7,9 | 470k |
| R8 | 56 ohms |
| R10 | 4.7M |
| R11 | 100k |
| R12 | 1M |
| VR1 | 100k potentiometer |
| **Capacitors** | |
| C1 | 470nF MKT or polyester |
| C2 | 10nF MKT or polyester |
| **Semiconductors** | |
| IC1 | 4011 quad 2-input NAND gate |
| Q1, Q2 | BC548 NPN transistors |
| **Miscellaneous** | |

Piezo sounder; Stripboard 25 x 97mm (10 strips x 39 holes); 5 x 1mm terminal pins; 14-pin IC socket, battery holder or 9V battery clip.

# INFORMATION CENTRE

by Peter Phillips

## Music power versus RMS power, the origins of the decibel and more...

***There are two main topics this month, both related through sound. The first discusses audio amplifier and speaker power ratings, and the second is about the definition of a standard cable which takes us back to the turn of the last century (1905), and explains how the decibel came about.***

Welcome to the 'New Millennium', as the media calls it. I'm not going to bore you with why it's not the new millennium (that's next year); instead, I'm going to get stuck straight into the first topic. It's to do with power ratings, amplifiers and speakers; a follow-on from an answer I gave a reader (Mark Evans) in the October '99 issue. Our first letter asks the questions, the next gives some answers.

*I would like to ask more about computer speaker ratings as raised in the October column. As you pointed out, speaker and amplifier power ratings can often be ambiguous and misleading, particularly the figures published in advertisements. I have noticed different terms being used such as power, average power, continuous power, music power and RMS power. So what are the main differences between these terms? I am particularly confused by the term 'RMS' in 'watts RMS'.*

*I am roughly familiar with the mathematical definition of RMS as applied to voltage and current (e.g. 'volts RMS' and 'amps RMS'). Most people in electronics know that the RMS value of a voltage or a current gives a measure of the average power in a resistive load. That is why the RMS value of voltage or current is frequently used instead of the average value. But what is the significance of RMS power? It cannot be the same as average power, surely? And yet it must have a lot of significance when applied to speakers and power amplifiers because it is so frequently used, not only in manufacturer's specifications but also in technical articles and columns (such as your own). Perhaps you or a reader can enlighten me and others on these matters.* (Herman Nacinovich, Gulgong, NSW)

Before I present the next letter Herman, which addresses your questions, first let me clear up the term 'average'. Average power in a purely resistive circuit is the product of the RMS voltage and RMS current. As far as I know, RMS power is not a measurement unit at all, although it's widely used, and in electrical theory is the same as average power. I believe continuous power is also the same as average (or RMS) power.

But this is not true for an RMS voltage or current: their average value is zero. The waveforms in Fig.1 might explain, in which a sinewave with a maximum voltage of 10V (7.1V RMS) forces a current with a maximum value of 1A (0.71A RMS) through a resistor.

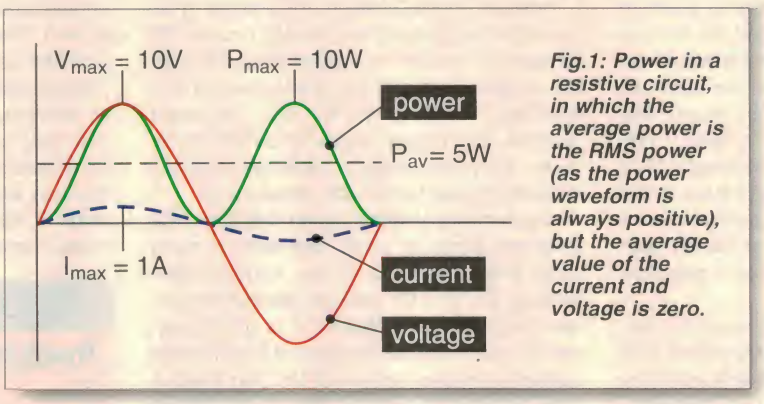



***Fig.1: Power in a resistive circuit, in which the average power is the RMS power (as the power waveform is always positive), but the average value of the current and voltage is zero.***

The resulting waveform for power is always positive, although at twice the frequency of the voltage and current waveforms. Hence its average value is 5W, and its peak value is 10W. Multiplying 7.1V by 0.71A also gives 5W, allowing for decimal error. Notice however that the average value of the current and voltage is zero, as there's as much of the waveform above the zero axis as below it.

The following letter is from a reader who works in the audio field. It's longer than I usually like to include, but it explains audio amplifier and speaker power ratings in a very practical way. As you'll read though, it seems the audio industry has its own rules about power ratings.

### Audio power ratings

*I was interested to read your reply to a reader concerning speaker and amplifier power ratings. I feel that parts of your reply were misleading, especially where you said "So a 100W (RMS) speaker can handle a continuous power input of 100 watts", and also your references to music power output versus RMS power output. To explain, consider a 100W amplifier with a rated load impedance of 8 ohm.*

*To check the power output of the amplifier, its output terminals should be connected to an 8 ohm dummy load, together with an AC voltmeter and an oscilloscope. It is also instructive to connect a DC voltmeter across the amplifier's DC supply rails during the test. First note the DC voltage supplied to the output stage of the amplifier under no signal conditions, which typically might be 100V (dual supply of +/-50V).*

*Now apply a sinewave at 1kHz to the input of the amplifier and adjust the input level until the amplifier output is just clipping, as observed on the oscilloscope. If the amplifier is working correctly, then based on the equation $P = V^2/R$, the AC voltage across the 8 ohm load resistor should be about 28.3V (RMS) to give an amplifier power output of 100 watts. This is commonly known as the RMS power output.*

*But note the DC supply voltage. This is likely to have dropped to perhaps +/-43V, because the added current drain at high output power, combined with the internal resistance of the power supply, has caused a drop in the available supply voltage. Nevertheless the amplifier was able to develop its rated power when fully driven with a continuous tone.*

*Now replace the tone with a typical music and speech signal, and adjust the level so that once again the amplifier is driven just to the point of clipping as observed on the oscilloscope. Two things immediately become apparent. Firstly, despite the oscilloscope indicating that the amplifier is being fully driven, appar-*

*ently to 100 watts, the output voltage meter will indicate approximately 11.5V AC, not 28.3V; an output some 8dB below the previously measured figure.*

*With 11.5V RMS the power output is about 16.5 watts, but from an amplifier previously found to deliver 100 watts. The explanation is that music and speech have a fluctuating instantaneous output. There's a peak level and a much lower average level. The peak to average ratio is typically taken to be about 8dB, although depending on the nature of the program material, in practice it can be as little as 3dB and as high as 14dB. The output meter has indicated the average output power, while the oscilloscope has displayed the peak output.*

*But the point is, the average power output an audio power amplifier has to deliver with music and speech is generally only about 16% of the so-called RMS output. This has a great influence on the heat generated in the amplifier heat sinks, the power supply components and most importantly in the average power delivered to loudspeakers (which influences the temperature rise in the speaker).*

*The second important point to note is that when the amplifier is fully driven with music and speech, the DC supply voltage will remain very close to the voltage measured under no signal conditions. This is because the power supply filter capacitors can hold up the supply voltage long enough to enable the short-term peak power output to be realised.*

*In this example, the supply voltage under these conditions will be 50/43 or 15% higher when the amplifier is driven with music and speech compared to continuous tone conditions. From this you can estimate that the power output — the music power output — of the amplifier will be 30% higher than the maximum output measured using a continuous tone. That is, the 100W amplifier will actually perform as a 130W amplifier under normal working conditions with music and speech. This legitimately is the music power output of the 100W amplifier.*

*Loudspeaker designers are well aware that the average power in music and speech is much lower than the indicated or 'RMS' power. So in giving a speaker a power rating, they allow for the much lower average power with music and speech that the speaker will need to handle. If a loudspeaker has a power rating of 100 watts, it does not mean that it will handle a continuous power input of 100 watts RMS. What it does mean is that it can be safely connected to a fully driven 100W amplifier carrying music and speech, but not continuous tone.*

*As explained above, under these conditions, the average power delivered to the speaker is much less than 100 watts — perhaps only about 16 watts — and the speaker is rated for these conditions. This rating allows for the duty cycle inherent in the fluctuating nature of music and speech.*

*One further point regarding speakers, of the total power delivered to a speaker system, the percentage of it within any one frequency band can be quite low. For example, within the frequency range 3kHz to 15kHz, the range reproduced by a tweeter, the actual power in the tweeter might be as little as 1% of the total power over the whole frequency range received by the speaker. So with a 100W speaker system, the power in the tweeter might be less than one watt. Certainly a tweeter in a 100W speaker system will not handle or ever need to handle 100 watts, even within its intended frequency range.*

*Many sound recording operators have ruined tweeters by forgetting to lift the tape off the replay head of a tape recorder before spooling the tape at high speed. Under these conditions, all the energy of the music and speech is transferred to the upper frequency range at an extremely high level, well beyond the capabilities of the tweeter. The usual result is a short burst of very loud high frequency noise, a puff of smoke and then silence! This is a stark reminder that a tweeter in a 100W speaker system will not cope with an input power of 100 watts. The supposedly mundane subject of audio amplifiers and loudspeakers and how they are measured and rated is much misunderstood. (Neil McCrae,* East Hawthorne, Vic)

Mundane Neil, not in the least; misunderstood, yes! Your description of audio power ratings is clearly based on industry practice; mine is from theory. Yours is obviously more valid, as it's how the industry rates its products. But, while I've got you Neil, is there a standard in the industry for the relationship between RMS and music power? You mention a percentage value, but I thought there was also a time value, or perhaps it's an alternative way of relating the two. And another question: do audio equipment manufacturers in America and Europe follow the same standard regarding RMS and music power output (amplifier) or dissipation (speaker)?

I have many more questions, as I'm not real happy about a situation when watts ain't always watts. The car industry would love a situation like this, in which it could bamboozle customers with claims of megawatt power ratings from a one litre engine, with the justification that this power only applies under certain conditions. So, is there's a standard for power ratings in the audio industry, and if so, what is it?

And staying audio for a bit longer, here's a request that I'm hoping a reader can help with...

# Information centre

## Speaker drivers

*I'm hoping you can tell me if there's anyone in Australia that custom manufactures speaker drivers. I believe Magnavox might have some time ago, but I know of no other company that does this.* (Leigh Witchard, Prospect, Tas)

I don't know either Leigh. My guess is no, but perhaps someone from the audio industry can help.

## More Standard Cable

In last month's column, I included several definitions for the term 'Standard Cable' in response to a question from a reader (Old Wilbur). I've since received a few more definitions, and given that these agree, perhaps we're getting there. Interestingly, although these explain the term Standard Cable, they also tell us about the origins of the decibel. Here's the first:

*Old Wilbur's query about a standard cable intrigued me so I looked up one of my old text books 'Communication Engineering' by W.L. Everitt, who explains what the standard cable was and how the decibel was defined (photocopy enclosed). I must be getting old as I realise I've now been reading EA for over 50 years.* (Alan Miller, Burwood, NSW)

Time marches on, doesn't it Alan. Thank you for sending this information, which says: "the so called 'mile of standard cable' was the first standard extensively used for telephonic transmission. It consists of physical values of 88 ohms resistance for Z1 and 0.054uF capacitance for Z2. It was originally a commonly used cable of 19 gauge copper, but modern 19 gauge cable has a different capacitance." (I assume Z1 is the series resistance and Z2 the parallel component.)

I was especially interested to read what this book says about the decibel: "If a single frequency standard must be used, the attenuation of speech transmission is most nearly like the attenuation of a frequency of 800 to 1,000 cycles. Formerly the unit most widely used was the '800-cycle mile'; i.e. current or power ratios were expressed in terms of the number of miles of standard cable that would cause the same ratio at 800 cycles. The attenuation of 886 cycles on a mile of standard cable is such that $P1/P2 = 10^{0.1}$. This ratio gave a convenient value, which could be expressed in terms of common logarithms and was adopted as a standard for all frequencies. This unit was first labelled the 'transmission unit'. Later its name was changed to the decibel".

So there's a bit of history for you, the origins of the dB. The next definition pretty much agrees with the above.

## Standard cable seems standard

*The following reference regarding 'Standard Cable' comes from A.E. Knowlton 'Standard Handbook for Electrical Engineers' 7th edition. I quote:*

*"The 800-cycle mile was commonly used at one time in expressing transmission equivalents. Its name is derived from the transmission loss of a so-called 'standard cable' which had a resistance of 88 ohms per mile and a capacitance of 0.054uF per mile. Since the transmission loss of such a cable is a function of frequency, which is in general different from other transmission networks, a comparison between the loss of such a cable and the loss of another network can be given by a single figure only if a particular frequency is specified. From experiment, it was decided that the loss at 800 cycles most nearly simulated the loss of a complex voice wave and so this frequency was used for comparison. Because of the inevitable misunderstandings which arose in the use of the 'mile of standard cable' as a standard of transmission loss, it has been generally abandoned." I hope this is of use.* (Don Hogg, La Trobe University, Bendigo)

It certainly is Don. At last we're getting some agreement on how things were done in the early days of telephony. I want to wind up this discussion, as space is limited, but this extract from the *Admiralty Handbook of Wireless Telegraphy* (1938) is worth including. It was sent by Richard Wiggins (Port Macquarie, NSW):

*Prior to 1923, the MSC (mile of standard cable) was defined as "The difference in loudness in an 800 cycle note, perceived by an observer comparing the notes from two equal telephones, one at the input and the other at the output end of a mile of standard telephone cable." The observed difference in loudness corresponds very nearly to a difference in power of 20%, and from this, the suggestion arose to use a standard power ratio step of $10^{0.1}$; this gives a difference of $10^{0.1}$ - 1, that is, about 25.9%. It needs a well-trained ear to detect a change in loudness (of a monotone) of as little as 10%, which is usually regarded as the lowest figure. Indeed, for most acoustic purposes, the decibel is defined as the least ratio of sound intensities that can be appreciated by the human ear.*

And to finally end this interesting foray into the past, here are the figures that relate the MSC to decibels. It's from a longer letter, but here are the main points:

## MSC to dBs

*A comprehensive answer to 'What's a Standard Cable?' may be found in 'Telecommunication by Speech' by Dr D.L. Richards (Butterworth 1973) pages 6 and 463-467, including the following extracts:*

*"Originally the standard cable used in the United Kingdom was identical in characteristics to that used for similar purposes in the USA by the American Telephone and Telegraph Company. The primary constants were a loop resistance of 88 ohms per mile and a capacitance of 54nF per mile. At a later date the primary constants also included cable inductance of 1mH per mile, and cable leakage of 1uS per mile." (5uS was quoted by Cohen in l916.)*

*When the use of 'miles of standard cable' (MSC) was superseded by transmission units in decibels or Nepers during the late 1920s, the following relationship was established:*

*1 MSC (British, with inductance and leakage) = 0.92209dB or 0.10616Np*

*1 MSC (USA, zero inductance and zero leakage) = 0.94670dB 0.10899Np*

*These relationships apply for the frequency 5000/2pi Hz (around 800Hz), which may be taken to correspond, for loudness, to the equivalent frequency of speech signals. I suspect this is more than Old Wilbur really wanted to know!* (Rob Wilkinson, Wellington, NZ)

I would never have guessed that such a topic would generate such interest, and lead into such interesting history. So, hopefully Old Wilbur has read the above, and for my part, thank you for the question.

## What??

This month's question comes from a guy I met in the USA who claims his father (Mike, a cleaner at the time) solved a problem that had flummoxed the engineers and technicians of a large printing firm. It's not a mathematical question, and the answer is simple enough, but it needs a bit of imaginative thinking. Here's the problem:

A large printing company had prepared a site for a new printing press ordered from overseas. However, when the press arrived it was found that the hole into which it was to be lowered was too neat to allow room for the cables holding the press. There was no other way to attach the cables to the press, and the hole was lined with reinforced concrete. Mike, while leaning on his broom, took all this in, then walked over to the chief engineer and told him how he could lower the 50 tonne press into the hole without ropes, cables, a crane or any mechanical aids, and without damage to the press. What was his suggestion?

## Answer to December

The only resistance value that can be made up seven different ways from the E24 range of resistors is 630Ω. That is: 10 + 620, 120 + 510, 160 + 470, 200 + 430, 240 + 390, 270 + 360 or 300 + 330. ❖

# VINTAGE RADIO

by Roger Johnson

# The Year That Was: 1929

***1929 really was a big year for change in the domestic radio — or 'wireless' as it was still called at the time. All-electric sets with balanced armature speakers meant better performing and better sounding radios, that were also cheaper to run. The first audio amplifiers for 'music reproduction' also began to appear.***

ONE OF THE MOST surprising things to come from researching the literature for 1929 is that the triode was still very popular, if not dominant in both electric and battery sets. As seen in Fig.1, RCA's model 60 all-electric superhet consisted of a string of type 227's and the ever-present type 171A output valve.

A flick through a compilation of US circuits shows plenty of electric sets making use of the one and only screen-grid type 224 in TRFs and superhets. But in the few superhets that existed, a type 227 triode was invariably used as a separate oscillator, rather than the familiar 'autodyne' described in this column about 18 months ago.

## Electric sets

"Just plug him into the light socket and hear him sing" was a familiar advertising line for 1929. But why the 'light socket', rather than a power point? This is interesting.

Reticulated electricity of different voltages and either AC or DC had been available to population centres in varying degrees from about the start of World War 1. If there was AC and DC mains available, the electric receivers could only be used where AC was available, because in the 1927 to 1933 period the radios were all designed with a mains transformer.

Most early domestic installations were to provide electricity for lighting only (Hence the expression "to pay the electric light bill"). About the only appliance available to a household was an electric stove. Many early stoves had a power outlet built in the switch panel, and this was often the only electric power socket for the whole house.

Glancing through the advertisements of the 1928/29 period would suggest that an electric fan, an iron and a radiator — apart from radios and gramophones — represented the sum total of electrical appliances! But there was no shortage of all-electric radio sets.

The ones that exist today, particularly the 'brand names' all stemmed from this period. AWA Radiola had 'electric three' and 'electric seven' models, Atwater Kent the 'electric six' and 'electric seven' (probably models 36, 37, 40, 41, 42 and 52, with six valves; and models 38, 43 and 44, with seven valves). Stewart Warner and Stromberg Carlson had similar sets, King its models 'H' and 'J', Astor its 'all electric one control neutrodyne', Crosley its 'gembox', and RCA the models 17, 33 and 60 — the eight-valve superhet pictured in Fig.1.

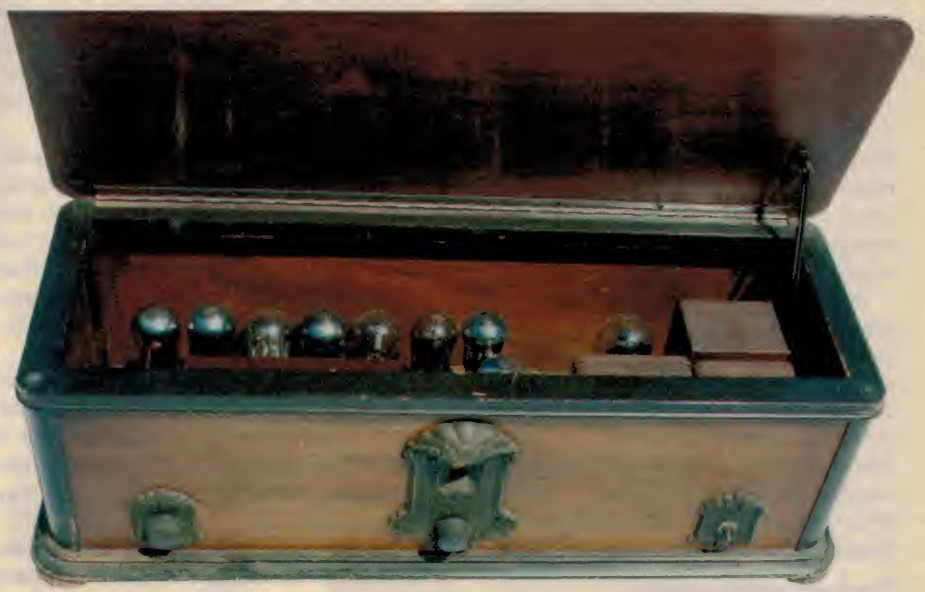


*Fig.1: A classic 1929 'coffin box' set: The RCA model 60 superhet, which uses no less than eight triodes.*

All of these sets received heavy advertising in 1929, but came in at a healthy price tag. The RCA superhet was priced at £85 with speaker, while the remaining six- and seven-valve sets were all in the £45 to £55 price range. Stromberg Carlson, Colmovox and Salanola were locally made brands, and offered electric three valve sets from about £27/10/-.

Later in the year, the RCA model 44 appeared in the advertisements as being 'the only imported set in Australia with screen grid valves'. The valve used was the UY224, but the claim is somewhat erroneous. The Cossor 'Melody Maker' was after all an imported radio, albeit a battery powered kit set, which also used a screen grid valve.

## Circuits

Apart from the superhet, as far as the six-triode TRF circuits go, if you've seen one you've seen 'em all! They were invariably an untuned RF followed by two tuned RF stages, detector, audio and output. Some had three tuned RF stages, requiring a four-gang tuning capacitor. The seven valve models just had an extra 171-A for push-pull output.

In the imported American sets, the valves were all type 226's except for the detector and output, which used a type 227 and 171-

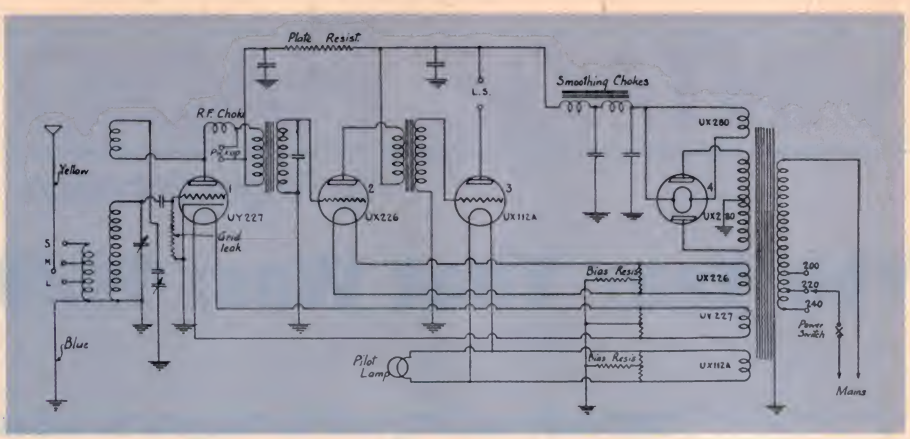



***Fig.2: The AWA Radiola 'Electric 3', which required a separate heater winding on the transformer for each valve!***

A respectively. Some did have type 227's in all sockets except the output.

The AWA Electric Three had four valves; type 227, 226, 112-A and 280 for the rectifier — which meant that the mains transformer had to have a separate winding for each valve! The circuit for this set is shown in Fig.2.

Astor's electric sets used British types, usually Osram MHL4 and P625, and Noyes Brothers department store in Sydney marketed a version of a Stromberg Carlson with their own brand name 'SEYON' (which was 'Noyes' spelt backwards), but which used four volt Philips types E415 in all sockets except the output, in which a C603 was used, and the rectifier where it had a Philips 4V type 1560.

The power supplies of these sets were invariably completely encased in a metal box which contained the power transformer, the filter chokes, and not uncommonly the 2uF paper filter capacitors as well. Then the whole was filled with pitch, with just a cable emerging from beneath. So repairing a power supply is not without its problems...

The rest of the power supply circuit was basically a wirewound voltage divider which supplied the back bias to the output valve as well as suitable voltages for the various stages. Cathode bias was obtained from the centre tap of the 1.5V winding for the type 226's, and that was it. The remainder of the circuit was transformer coupled, using either RF or audio transformers. The only other 'component' was a block of bypass capacitors.

## Screen grid valves

Previously we've noted that 1928 introduced the screen grid valve. We can safely say that 1929 consolidated it. Initially, the screen grid circuits were battery circuits, and one, perhaps two were used as RF amplifiers ahead of the detector. Where one stage of screen grid RF was used, the detector was invariably regenerative.

However, the 'Standard AC 4' described by the late Ross Hull in *Wireless Weekly* for 19th July 1929 uses two Philips type E442 RF stages, a Philips E424 detector and an output valve — "a variety of which may be chosen as discussed in the text". This circuit is quite a departure from the norm, as can be seen in Fig.3.

The grid circuit of V1 is untuned. Then follows two stages of tuned plate-tuned grid circuitry (otherwise known as 'bandpass' tuning), requiring a four-gang capacitor. In the circuit, this whopper is C8-C9-C10-C11. Four tuned stages appeared not to be enough, though, because regeneration is thrown in for good measure! (T2-C12)

Notice also the provision of an output transformer. This is designated a 'Ferranti OP 1', a particularly good choice; in fact it was the best available. This transformer had a primary - secondary ratio of 1:1, and they were priced at 41/-.

There are two reasons for the output transformer. Firstly, even a modest output valve such as a C603 or 171-A is still going to draw something like 20mA of plate current, which is far far too much for a horn speaker, in case anyone was unwise enough to consider using one. (10mA is as much as anyone should consider poking through a horn speaker.).

However the second and more important reason is that a transformer was vital for the operation of balanced armature speakers. This is despite the fact that they have an input impedance compatible with that of a triode output valve. The windings in a balanced armature speaker are wound in such a way that no matter how they are connected, one or other of the magnet poles will be de-magnetised by the passage of DC flowing to the plate of the valve.

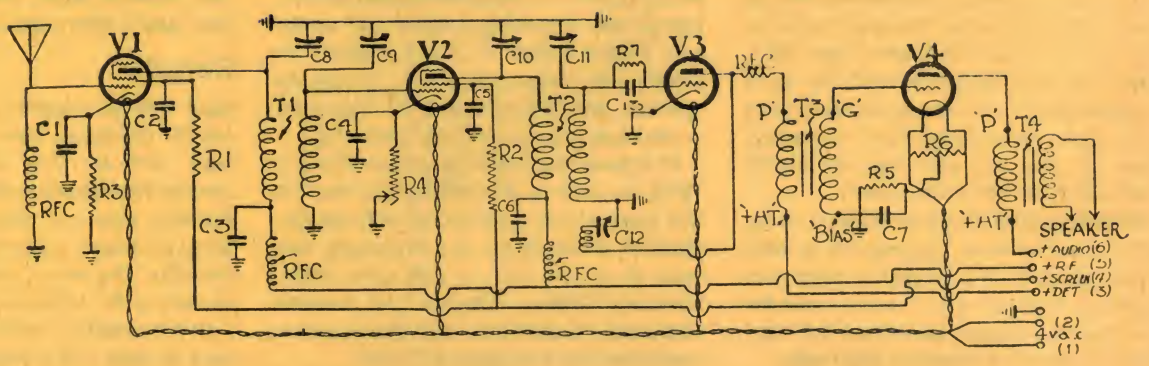
The Standard AC 4 would have been a very selective set and probably could have done without regeneration. Two stages of bandpass tuning is rather unwise unless exceptional care is taken with the coils. The amount of coupling is critical. Too much and it would oscillate uncontrollably.

The coils specified were commercially wound, and no instructions were given for winding your own. They were arranged in such a way that they were wound on separate formers, and for each T1 and T2, the formers were placed one atop the other, but with the right hand edge of one in line with the left hand edge of the other. In other words, they were offset by the diameter of the formers. This was done to reduce the amount of coupling, and each stage was extensively shielded by aluminium compartments.

## Battery eliminators

Even if the radio consumer was reluctant to purchase a new all-electric set (remembering

***Fig.3: The Standard AC 4, described in Wireless Weekly for 19 July 1929.***



that they cost from £30 for a simple set to £60 for something decent), there was no shortage of battery eliminators on the market and they were heavily advertised.

Most vintage radio enthusiasts are probably familiar with the Philips varieties. These must have been well made, for they are the most numerous to have survived. In conjunction with the B eliminators was the 'trickle charger', which kept the filament accumulator up to the mark, and saved someone their fortnightly trip to the motor garage to have it re-charged.

Philips were by no means the only ones available, but they are the ones that seemed to have survived. 'Balkite', 'Pilot' and 'Emmco' are three of the other popular brands.

The idea was to literally run your battery set from the electric mains. Thus the battery all-triode 'coffin box' radio of the 1923 to 1928 period could now be entirely operated from the electric mains.

## John Murray Moyle

The name John Moyle is familiar to many enthusiasts, being the first technical editor of this journal's predecessor, *Radio and Hobbies*. His life and contribution has been most eloquently discussed by the late Neville Williams in his column 'When I Think Back', in *EA* for September and October 1989. For those fortunate enough to have copies of *Wireless Weekly*, his name appears there as well.

Where then, would you expect to see his early work? It is not in *Wireless Weekly*, but instead the Melbourne based rival magazine, *The Listener In*. Readers will recall that he was born and educated in Melbourne.

Unfortunately, the author does not possess a complete set of *The Listener In* (who does?), but the circuit shown in Fig.4 must surely be one of his earliest efforts, in the issue for October 23, 1929. As he was born in 1908, he would have been only 21 years of age when describing this circuit.

By the way, this circuit contains a fairly obvious drawing mistake. Can anyone spot it? (Hint: the detector grid would be very positive if wired as drawn.)

Answer: There is a small value (250pF) capacitor missing from the connection from the anode of the RF stage to the tap on the detector grid coil. (Just in case anyone is in doubt, the capacitor is quite clearly shown in the wiring diagram. It's also mentioned in the caption to the circuit.)

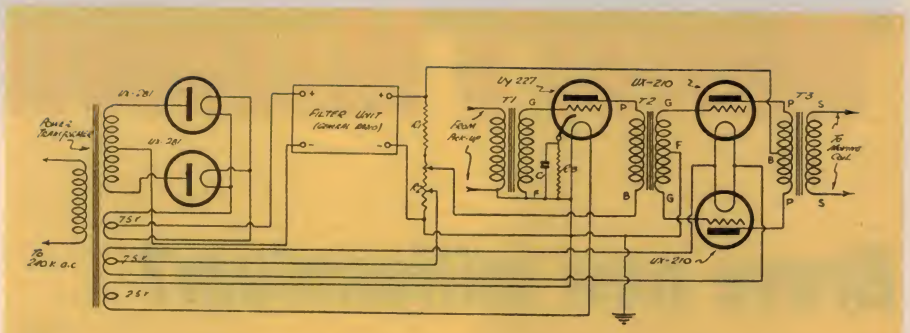


*Fig.5: Was this the beginning of hifi? An amplifier described in the October 25, 1929 issue of Wireless Weekly.*

## Dawn of 'hifi'?

Because of the newly released electrodynamic speaker, which one could argue revolutionised radio, there developed new circuits to drive them. The free-standing 'audio amplifier' was released, both in ready made varieties and also in the form of descriptions in the popular magazines for home constructors.

The famous Loftin-White direct coupled amplifier has already been described by my forerunner with this column, Peter Lankshear. However, an amplifier claiming impressive results for 'the reproduction of music' was described in *Wireless Weekly* for 25th October 1929.

The circuit is shown in Fig.4. It holds no surprises, and the quality would depend largely upon the choice of transformer. The Ferranti units are recommended, together with a Magnavox moving coil speaker. This setup would probably be about as good as one could get for the home constructor, and probably on a par with the best of the commercial brands.

Along with ready-made amplifiers, which were not cheap, were a variety of magnetic pickups. These pickup heads had a tracking pressure similar to, if not heavier than a purely acoustic head. Some of them reached four ounces (100 grams!), and a steel needle had to be replaced each time a record was played.

## R/C coupling

In closing our curtain on 1929, mention must be made of R/C coupling, which was emerging as an alternative to transformer coupling in the audio stages.

Some circuits described individual components such as '1/4 meg' (i.e., 250kΩ) plate load resistors, and so on, but there were also available curious little devices calls 'resistance coupling units' which contained an anode load resistor, a coupling capacitor and a grid leak resistor all wired and assembled — with four connecting terminals P, B, G and F, corresponding exactly with the terminals on an audio transformer. Just to make things easier!

Yes, 1929 was a big year in radio, only to be marred by the onset of the Great Depression. ❖

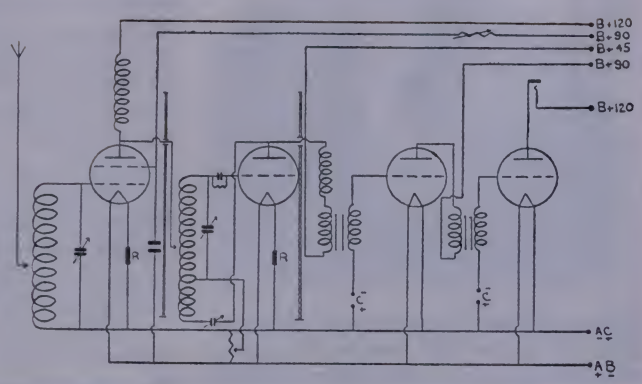



*Fig.4: One of John Moyle's earlier (earliest?) efforts, a four-valve battery set with screen-grid RF stage described in the Melbourne magazine 'The Listener In' for October 23, 1929.*

# MOFFAT'S MADHOUSE

## Brave new millennium?

"Having just read July's EA, including Moffat's Madhouse, I wonder if Tom sleeps at night? All that FUD (fear, uncertainty, and doubt) surely keeps him tearing apart his operating system, looking for more 'evil' data. Let's hope EA's readers realize Tom's ramblings are not much more than unsubstantiated musings."

This comment was in Jim Rowe's FORUM column in the November 1999 issue, in response to my ravings about the GUID, a serial number implanted within your computer. Well, folks, you ain't seen nothin' yet. This month we're going to talk about a serial number implanted in the back of your hand.

This subject came up after a friend of mine became 'mother' to two young kittens. They were hauled off to the veterinarian for various procedures routinely performed on pets in this part of the world, including several injections. One of these needles contained not a vaccine, but a solid glass object the size of a grain of rice - an implanted identification chip. This was designed to help identify a pet's owner if the animal was picked up as a stray.

The kitties were returned along with a brochure describing the AVID FriendChip, described as a technological miracle. "Now you can easily protect your loved ones before it's too late". True, the implanted ID chip can bring only good when used in that application. But, as I read the brochure, it became obvious that there was nothing whatsoever that would prevent the very same device being implanted in a human.

The ID chip contains a factory-programmed serial number which can be read by holding a wand-like scanning device within 100mm of the chip. Each chip has a different number, up to 34 billion unique numbers.

The implantable device consists of a sealed tube of glass containing two major components. One is a coil of wire wound around a ferrite rod; a transistor radio antenna in micro-miniature. The other component is the chip itself. The tube is made of soda glass, which is totally inert; it does not react with any of the body's juices.

The tube is covered with some stuff called Bio-Bond which promotes the growth of body cells around the chip, locking it in place. In small animals the chip is usually implanted in the back of the neck, and Bio-Bond makes it stay there. Otherwise it might begin working its way through the bloodstream, making it hard to find. The chip could also end up in the heart or brain, and that could well be fatal.

Each chip is supplied ready-loaded into a single-use hypodermic needle. The blurb says the injection is virtually painless, but when you consider the needle must be thick enough for something the size of a grain of rice to pass through, one has doubts. I hope that never happens to me, but the way things are going, I may have no choice.

### Little info

Information on the chip technology is a little sketchy (there are competing systems and thus trade secrets), but a little guessing may shed some light. The chip has no power source of its own, and thus lasts for the life of the animal. The scanner emits one of two frequencies, 125 or 134.2kHz. It's antenna is in the form of a loop, which couples the energy into the tiny 'loopstick' antenna within the implanted glass tube. Part of this is rectified and provides the operating power for the IC.

***If we could all implant one of these in the back of our left hands, the world would be a much better place. Really.***

Once energized, the chip transmits its serial number back to the scanner. One way to achieve this might be to have the scanner emit short pulses instead of a sine wave, and then listen between each pulse. The IC could well be a fixed-programmed shift register, which would send its number out as a serial string, clocked by the pulses from the scanner. If the coil/ferrite assembly was of fairly high Q, it could continue to resonate after the scanner pulse stops.

The serial string from the IC could be used to damp the resonance for a 1 data bit, and let it ring for a 0. The scanner, listening for continued resonance or lack of it, could then reconstruct the number within itself. As I said, this is sheer guesswork, but it seems like one way to do the job. The TIRIS company, an offshoot of Texas Instruments, makes read-only biochips containing 64 bits, and a read/write version of 80 bits. I won't even hazard a guess how one would write to these things...

There is nothing at all in this technology that would preclude its use in humans, and indeed that is happening already. In 1993 the US Food and Drug Administration passed the Safe Medical Devices Registration Act which requires that every artificial device implanted in the human body be accompanied by an ID chip containing basic medical information, the name of the surgeon who did the operation, and the manufacturer of the ID chip.

Artificial devices are being used more and more in the US, mostly for cosmetic purposes. If you have a weak chin you can have a stronger chin implanted, and of course there are the breast implants. One can see advantages in ID chips in this case because if a woman turns up in a doctor's surgery with an exploding breast implant, the doctor can immediately scan her and see who did the job, and what exactly was implanted.

So the technology is there, and it has been proved safe in humans. It's only one short step from having an ID chip implanted in every baby at birth. The USA is so needle-happy now that every baby undergoes something like 44 injections by the age of six

months. They'd hardly notice another one.

This idea has been seriously suggested by many people in high places as the ultimate national identity scheme. The reason being given is to stop illegal immigration, and to prevent illegals from using things like medical and educational services they're not entitled to.

## Mr. 264534985

National identity schemes have been floated before. In Australia it was the ill-fated 'Australia Card' which got knocked on the head good and proper. Being such a paranoid fellow I campaigned hard on that one, wearing badges and bumper stickers and attending public meetings. In that case it worked, but a de-facto national ID scheme seems to have developed anyhow, in the form of the tax file number.

Here in the USA, it's the social security number, or SSN. This number was originally issued to people when they got their first job. A portion of their income was put into a government account to fund their pensions when they got too old to work. When you changed jobs, the SSN went with you to make sure your income deductions went into the same account.

In theory, the law says it is unnecessary to give out your SSN to anyone other than your employer or the Social Security Administration. But in reality, the SSN is demanded for almost every financial transaction, to act as identification. You cannot open a bank account unless you hand over your SSN. You cannot take out a loan, buy a car, go to the doctor, rent a house, or do much of anything without your SSN. This is getting so blatant that my health insurance company account number is actually my SSN. Nothing at all subtle about that.

As we said, the law says nobody can force you to hand over your SSN, but if you don't then you won't have a bank account, a car, a place to live, or any medical treatment. You'll have to arrange to be paid by cash, not cheque (a practice in Australia which I sorely miss) or otherwise you can't cash the cheque — no bank account! So, the Social Security Number is, in reality, a national identification number.

We're only a short step from implanting Social Security Numbers, or Tax File Numbers, under the skin. To be exact, under the skin on the back of the left hand. That's what's being seriously suggested. Then you'd no longer need to carry those messy Social Security cards, or credit cards, of medical care cards, or even wallets or money. For every transaction in life you would simply wave your hand over some scanner and it would say, "Hey, that's Tom!", and your bank account would be debited directly. Or the doctor would agree to see you. Or you'd be sent to jail for publishing improper thoughts.

Doesn't this sound great? All so modern and efficient. Nothing to worry about as long as you do nothing wrong. Every citizen of the land will be so well behaved, crime will become a thing of the past. But that's what Hitler thought too when he had ID numbers tattooed onto the wrist of every Jew. Today society savagely attacks Hitler for tattooing the Jews, yet the same people welcome microchipping of all persons.

I think a lot of the problem here is philosophical. Most people just "want to be me", not a numeric cog in some enormous organism. We want to wander the mountains or the beaches in isolation and complete privacy, knowing that some park ranger can't come along and scan us for user fees.

**I think a lot of the problem here is philosophical. Most people just "want to be me", not a numeric cog in some enormous organism**

Some people want to simply 'drop out' for a while, and if there's no crime involved, why not? That's what the hippies did. How many people at Nimben had ID cards? I'd venture, not very many. They were free, and proud of it. Even later — When I was working on search and rescues, Tasmanian Police sometimes said they were pretty certain the person being searched for had 'done a bunk' — shot through forever to start a new life.

Do you remember some time back, there was an awful train crash in England? Many were killed, mangled beyond recognition. The death toll was reported as "X" but the missing were reported as "X + quite a few more". Some people had heard of the unidentifiable bodies and taken advantage of the situation, immediately heading for Heathrow Airport and an escape from a dull and unhappy life.

Had the whole British population been microchipped, the escapees would have been caught due to the people they weren't rather than the people they were. Because every train wreck body, mangled or not, would have had a scannable ID microchip. No thank you, not for me!

## Shields up!

Back to my computer paranoia for a moment: I've got my trusty laptop locked down so tight now that nothing can get into it. NOTHING! This is indeed a desirable situation, much like putting a gate in your front fence so strangers can't wander around your yard, picking your flowers. This still requires the use of some non-Microsoft software, but now there are some new techniques available from a web site, http://www.grc.com/default.htm.

This site is run by an inspired hacker who has learned how to slam the door on everything with his 'Shields Up' scheme. The site welcomes you with a display of some of your personal information from your own computer, just to show you how vulnerable it is. Then you can run a couple of routines 'Test my Shields' and 'Probe my Ports'. Shields goes after the networking information your computer offers to the internet, and Ports tests whether your computer will accept connections for FTP, telnet, finger, https, etc. The results then show whether your ports were open to entry, present but closed, or hidden altogether.

Some computers I've tried it on look like they're standing in the street with no clothes on, everything bared for all to see. But now, after some more tweaking, my computer is delivering a perfect score: everything is 'closed' except for the HTTPS feature which shows up as totally absent. That's good, because that's the thing you use to send your credit card number.

OK, OK, so I worry too much. But you should try this site and chances are you'll start thinking like I do, if only just a little.

Happy New Year! (assuming we are all still here....)❖

# OPEN Fist

BY STEWART FIST

## The powerline problem

The International Electrotechnical Committee (IEC) which is one of the oldest and most conservative of the United Nation's regulatory organisations in Geneva, is proposing the establishment of a new technical committee to be called 'Human exposure to EM fields'.

Under the heading 'Purpose and justification' they say: "There is now great worldwide concern about the effects of electromagnetic fields (EMF) on the health of exposed persons, either the general public or workers under occupational conditions." And they list "numerous organizations [which] are carrying out studies to clear up the biological and medical aspects."

The IEC has already decided not to deal with either biological/medical investigations or the specification of exposure limits, but it will instead "focus its activity in this field on the technical aspects. These include, description of the EM environments, measurement methods (equipment and procedures) and calculation methods [employed] in two frequency ranges; low-frequency (0 to 100kHz), and high-frequency (100kHz to 300-400GHz)".

It is really quite amazing that a century after electrical power became widely used in our society, we are only just now beginning to focus on the need to measure the "low frequency magnetic and electrical fields with regard to human exposure of human beings". Only now are these international regulators coming to grips with the "special requirements for instruments, and guidance for measurement".

To my knowledge, there's been no radical new biomedical discovery which has bought on this rush of activity, other than a gradual accumulation of evidence. Most of this evidence points, as with the RF problem, to a low-level increased incidence of some forms of childhood cancer (in this case acute lymphatic leukemia or ALL), breast-cancer, as well as a few other less significant forms. Also laboratory research regularly appears to find changes in hormones and messenger chemicals in humans and animals with heavy EMF exposure.

It is important to emphasise that these findings all appear to suggest that the incidence of such effects in the general population is low, although the conditions under suspicion are anything but trivial to those concerned.

This could mean that only a percent or two are genetically susceptible, or it could mean that low-frequency EMF exposures increase the chance of getting these problems in otherwise normal people. The cancer, for instance, could be triggered by a random coincidence when the exposure occurs at a time when a single cell with earlier damage is at a critical stage in cell-division.

The worse-case scenario would be to suggest that we are all having pre-cancerous conditions promoted throughout our lives. Since we all live in an environment of 50 and 60Hz electro-smog, we may not identify causal links in specific incidences, because the general exposure is so uniform.

In the years of the famous London coal smog, a high level of lung problems was still mainly attributed to British weather and the fact that people packed together like sardines in the London underground. Yet as soon as coal was banned in London and the smog disappeared, the incidence of lung problems dropped sharply. Only then did the cause become clear.

Epidemiology is a good research tool for identifying small differences between at-risk populations (clusters) and the general public, but it is totally ineffective when the causal factor is widely distributed and experienced equally by everyone. Statistics need exceptions.

**How could they know the magnetic field exposure of a kid back in 1946? This type of study, by necessity, works from historical records**

### 1979 study

The current spate of concern about power-lines and mains-power dates from a 1979 study done by two American academics, Nancy Wertheimer and Ed Leeper in Denver, Colorado. Their research looked at 344 children (under 19) who died from cancer between 1946 and 1973; they showed that these victims were two to three times more likely to have lived within 40 metres of a high-current power line, than were children studied as controls.

Magnetic fields are the key metric used in these studies because houses, trees, etc. block electrical fields. In the Denver study, those children with the highest exposure (above 2mG) were about three times as likely to have leukemia than those living in homes ranked as having low magnetic fields.

The study was criticised on a number of grounds. The first and most obvious criticism is that people from different backgrounds and work/life-styles live in different geographic locations. You wouldn't expect kids from upper-crust families to occupy houses under power-lines. So other factors ('confounders'), like diet or general hygiene, could be the cause.

However, it is wrong to assume that epidemiologists are idiots. If this factor is obvious to us, it is probably obvious to the researchers, and in this case they took considerable trouble to check whether socio-economic factors could have been the in play.

For instance, in South West USA, the lower socio-economic groups tend to be itinerant workers who tend to randomise their power-line exposure through regular changes in residence. So, equally, it could be that these people were less likely to have long-term power-line exposures.

In their report the authors state: "The finding was strongest for children who had spent their entire lives at the same address, and it

appeared to be dose-related. It did not seem to be an artefact of neighbourhood, street congestion, social class, or family structure."

The second major attack on the Denver study was over the measurement of magnetic fields. How could they know the magnetic field exposure of a kid back in 1946? This type of study, by necessity, works from historical records.

Wertheimer and Leeper's solution was to create a simple wire-code and use historical maps of the power distribution system. They did a series of magnetic field readings around different types of power-lines, then allocated each to a code-category. They believed that it was reasonably safe to assume that the same sort of field levels would have been found in the past.

The power-generation industry pounced on this, of course, telling the media that the researchers had only "guessed" the exposure levels, and said that they "took no actual measurements of the electrical fields in the homes of those who had cancer".

Most journalists were ignorant enough to swallow this line, and so the American media over-sensationalised the finding one week, then condemned the research techniques the next. No one bothered to explain that there is no alternative to such an approach when researchers are dealing with historical records. If they only deal in the statistics of current childhood cancers, the numbers are generally are too low to be significant — so you either use estimates, or you don't do research.

## Further studies

An eminent epidemiologist named David Savitz later decided to check the Denver findings, placing special emphasis on whether the assumptions made about wire-codes and magnetic field exposures were correct. He came to the conclusion that they were quite accurate.

Because of the industry attacks on Wertheimer and Leeper, Savitz conducted another study which was supervised by a panel of independent scientist in the same area. In 1991, he published a report on 356 childhood cancer cases recorded between 1976 and 1983, and he found almost identical results to the original.

Savitz's work was extremely comprehensive and difficult to criticise on methodological grounds. He added dosimetry to the techniques of just looking at wirecodes, and he still found a statistically significant increase in childhood leukemias at magnetic field exposure levels down to 2-3mG. This is 1/500th the level believed to be acceptable by the International Radiation Protection Association.

Other similar investigations followed around the world. One by Feychting and Ahlbom was possible only in Sweden because this country keeps a very comprehensive cancer registry. They looked at people of all ages who had lived within 300 metres of any of the nation's 220kV and 400kV power lines between 1965 and 1985, and the corridors were deliberately wide enough to include both exposed and unexposed homes — half a million people in all.

This meant that a control population could be selected from matching geographical and socio-economic groups, and in the study strenuous efforts were made to assess the possible effects of other factors such as air pollution. They also found a statistically significant increased risk of childhood leukemia — but not with adult cancers.

By 1986 there were 17 major studies of this kind, and 15 of these showed an association between some forms of cancer and EMF exposure — all at low incidence levels — but many on, or over the borders of statistical significance. There are also a few quick and dirty studies done by various power companies designed to prove safety, but generally these can be easily identified and ignored.

This isn't the end of the powerline saga by any means. In the past fifteen years the battles between those who believe that high levels of exposure to mains-power can increase cancer, and those who don't, have become far more intense. Also, epidemiological studies are often good indicators of areas that need research, but they lack the controls that give us confidence in the findings. But I'll leave that discussion for another column.❖

***Electronics Australia** is one of the longest-running technical magazines in the world. We started as **Wireless Weekly** in August 1922 and became **Radio and Hobbies in Australia** in April 1939.*
*The title was changed to **Radio, Television and Hobbies** in February 1955 and finally, to **Electronics Australia** in April 1965.*

*Here are some interesting items from past issues:*

# 50 years ago

## January 1950


**Sun Future Source of Energy:** The sun not the moon may be the principal source of power for the world in future days, it was predicted by Frank R. Benedict of Westinghouse Electric Corporation Pittsburgh.

SOLAR energy, he said, holds promise of supplementing our dwindling supply of coal, oil and natural gas, and may ultimately meet all the needs for power. It is common belief that in atomic disintegration we have an untapped source of practically inexhaustible energy, he continued, but this is not true. Limited amounts of the two fissionable elements, uranium and thorium, will control the broad scale applications of atomic power.

While "unrenewable" sources of energy such as coal, gas and oil now are our principal power sources, they can continue to provide all energy requirements for only another 100 to 300 years. Beyond that, the "continuous" sources, such as the sun's radiation, vegetation growth and water-falls, offer the chief hope.

# ...25 years ago

## January 1975

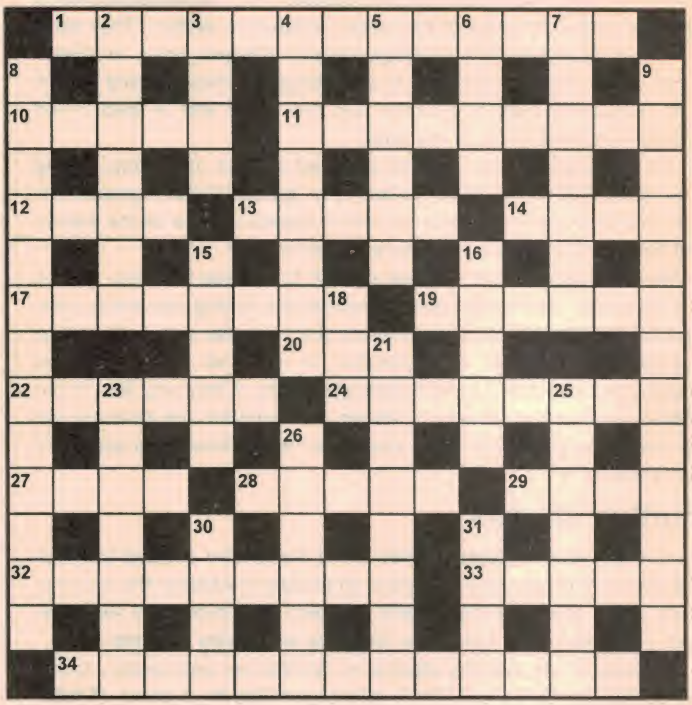

**On the cover:** An important development in commercial communications in recent years has been "fax" - the facsimile transmission of documents and charts over unlimited distances using public or private telephone lines.

Shown on the front cover is the Plessey Remotecopier which is capable of transmitting an A4 document in just four minutes.

**8-track unit from Pioneer:** Tape cartridge decks have traditionally been limited to replay only but the Pioneer H-R99 deck offers full stereo record facilities, allowing users to prepare their own 8-track tapes or to re-record cartridges which have outworn their welcome. Pioneer claim that the H-R99 is as easy to use as the more conventional cassette record / play decks.

**Stereo FM on air in Sydney:** By the time this issue goes on sale, FM / Stereo broadcasting will have become an everyday event - in Sydney at least. The VHF FM band, hitherto occupied only by television signals, will be carrying a foretaste of good things to come, thanks to the initiative of the Music Broadcasting Society of New South Wales.❖

# Crossword



## ACROSS

1 Motorised winder. (8,5)
10 Parts of a communication network. (5)
11 Voltage. (9)
12 Hyperbolic function. (4)
13 Early weather satellite. (5)
14 Gateless triac. (4)
17 Again followed path. (8)
19 Co-inventor of a radioactivity counter. (6)
20 Equipment fora radio base. (3)
22 Time rate of these is the hertz. (6)
24 Said of tape used for recording. (8)
27 US state where transcontinental telegraph was linked. (4)
28 Mechanism which multiplies power. (5)
29 Prefix meaning half or partly. (4)
32 Name of effect with magnetostrictive straightening. (9)
33 Part of a gearwheel. (5)
34 Energy-converting machine (8,5)

## DOWN

2 Series of scientific satellites. (7)
3 Surface treatment: — hardening. (4)
4 One who fixes faults. (8)
5 Insulating material. (6)
6 Particles in a dissolved electrolyte. (4)
7 Maximum attainable altitude. (7)
8 Motorised golf-cart. (8,5)
9 Replacement for the gas lamp. (8,5)
15 Sent by facsimile machine. (5)
16 Lodes. (5)
18 Reduce luminosity. (3)
21 Said of chemically-produced electricity. (8)
23 Type of cable. (7)
25 Instrumental vibration. (7)
26 Cutting tool. (6)
30 Mass of precipitated particles. (4)
31 Prefix indicating factor of $10^{18}$. (4) ❖

## December's solution:

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Electronics Australia's

# Professional Electronics

Touchscreen Technology

Diamond Cut Millennium Audio Toolkit

Bluetooth takes off

Wearable PCs

Carly Fiorina want's to 'Rock the boat' and get HP back on track...


Hantheld communications: Kenwood's UHF CB and Ericsson's Chatboard for email from your mobile

HIGHLIGHTS


## Encryption hack delays DVD audio products

Matsushita Electric Industrial Co., which is better known by its Panasonic brand name, expects a six-month delay in the launch of DVD Audio products as the format's developers scramble to find a new copyright protection system.

DVD Audio was to use CSS2; a newer version of the content scrambling system (CSS) employed on DVD Video. Those plans are now in disarray after the CSS encryption system was recently hacked, the company said.

"Because of the hacking on DVD Video, industry people are worried about the possible hacking on DVD Audio, and so people are talking about much stronger protection," said Yoshihiro Kitadeya, a spokesman for Matsushita Electric. "Matsushita will propose a new system of copy protection with a much stronger key and completely new encoding system."

The company, together with Toshiba Corp., Intel Corp. and IBM, came up with the CSS2 format and are now studying a replacement. Once agreed, the four will propose it to the DVD Forum for standardisation.

"The delay will hit all planned products with a capability to play DVD Audio," said Kitadeya, who added that the company anticipates a launch in mid-2000 for the format. A spokesman for Toshiba said his company was looking at a similar delay as the new system is worked out.

With products now planned to begin hitting the shelves in the 2000, the format will have lost a year on Super Audio CD, a Sony-developed next-generation audio CD format. Sony began selling Super Audio CD products in Japan in May 1999, and around 70 titles are already available for the format, which is mainly confined to use by audiophiles at present.

## Industry leaders join Bluetooth wireless effort

Efforts to develop wireless Bluetooth technology have gained momentum recently as four US-based vendors said they would help promote the emerging standard.

3Com, Lucent Technologies, Microsoft and Motorola said they will join the five founders of the Bluetooth Special Interest Group – L.M. Ericsson Telephone, IBM, Intel, Nokia and Toshiba – to form a nine-member Bluetooth Promoter Group.

The group will focus on improving the Bluetooth specification and conducting 'interoperability' tests, the companies have said in a joint statement. The nine companies will combine their skills to help promote Bluetooth as Bluetooth-enabled products come to market.

Bluetooth promises to connect up to eight devices, including PCs, mobile phones, handhelds and peripherals, using low-frequency radio waves to transmit voice and data. At the moment, the industry is focusing on incorporating this technology into mobile devices but Bluetooth technology can also be integrated into almost any product that switches on and off; such as household appliances, cars, consumer electronics and stationary office equipment. Having more vendors support the Bluetooth specification will also give users greater choices in what devices they can link together.

Bluetooth products will not be ready anytime soon, however. More than 1,200 vendors who want their devices to qualify for the Bluetooth seal have to undergo interoperability tests at a Bluetooth developers conference, held during December in Los Angeles. Until then, no market-ready products can be put on the market.

Despite this, Ericsson has unveiled the Bluetooth Headset, a practical cellular phone headset that connects to a mobile phone by a radio link instead of a cable. It is the first ever hands-free accessory to incorporate Bluetooth technology, the future industry standard for wireless communication between devices. The Bluetooth Headset will be available on the market in mid 2000.

The Ericsson Bluetooth Headset is a lightweight, wireless mobile phone headset, with a built-in Bluetooth radio chip that acts as a connector between the headset and the Bluetooth plug on the Ericsson phone. When

your phone rings, you can answer by simply pressing a key on the headset. If you want to make a call, you press the key on the headset and voice recognition is used to initiate the call. The phone can be up to 10 meters away – in a briefcase, your coat pocket, or even in another room – while you speak and remain completely mobile without cables dangling about. Weighing only 20 grams, the Bluetooth Headset sits comfortably on either ear and can be used with Ericsson T28, T28 WORLD and R320 cellular phones. This intelligent cellular phone accessory is the first consumer product from Ericsson that uses Bluetooth.

## Siemens at Macquarie University Research Park

World leader in electrical engineering and electronics, Siemens, has made a long-term commitment to Macquarie University Research Park

by moving into a purpose-built facility masterminded by Macquarie University and developer/constructor, Baulderstone Hornibrook.

Macquarie University Research Park is a privately funded and self-sustaining joint venture between Macquarie University and Baulderstone Hornibrook. Facilities are custom-designed to meet individual needs both in a built sense and commercially.

With approval gained so far for around 57,000m$^2$ of floor space in facilities ranging from four to nine levels on long term leases or outright purchase, companies already committed to the park include, US medical industry supplier Becton Dickinson, Dow Corning, Goodman Fielder and Covance. SPHC will also be involved through its 120-room Travelodge development and associated Centra corporate facility in conjunction with the MGSM.

The imminent construction of the Chatswood to Parramatta rail link by 2006 adds more long-term incentive for corporate participation at Macquarie University Research Park – a technology installation being viewed as a potential 'home-grown Silicon Valley'.

For further details contact Bill Steele, Macquarie University Research Park on Ph: 9850 9278, or Andrew Levido, G.M. – Information & Communication, Siemens on Ph: (02)9491 5288.

## Japan's wearable PC

Those tired of hauling around 'portable' computers may be able to wear a Pentium PC from next year, thanks to Japanese camera-maker Olympus and IBM Japan, who have just revealed a prototype of a wearable PC.

The monitor is a 100 gram 'monocle' headset that projects a 10

inch virtual screen. The mini-monitor flips out from the headset and covers one eye.

The hardware is stored in a 380 gram box, which is controlled by just three buttons. It has a Pentium processor, 64 megabytes of memory and runs Windows 98. A banana-shaped handle with a mouse and right-left click buttons is used to select icons on the virtual screen. The battery pack lasts up to three hours.

The Wearable PC doesn't have a keyboard yet, but "we may develop that in the future," said Olympus spokesman Shinichiro Murakami. He said the companies would decide next year when to launch the computer.❖

# COMDEX Currents

***Comdex is known as the biggest and best computer show in the world. Over the years it has become the place to release your latest piece of gee-whiz technology, operating system or even just an idea. It isn't all gadgets and super computers though — Comdex is also known as the place where major players in the computer industry announce where they see themselves heading, and try to get everyone else to follow.***

*By Paul Swart*

***Bill Gates may see his 'Mariner' Web Companion as a "...component part of our Web strategy", but isn't that a palm Pilot he's pointing to?***

Comdex certainly got of to a blast this year when Bill Gates, as he has for the past four years, opened Comdex with a 90-minute Sunday evening keynote speech.

It was watched by a record crowd of 15,000 people stuffed in toseveral giant ballrooms, at the Las Vegas Venetia Hotel that is surrounded by water and tourist-ferrying gondolas.

Many had expected Gates to comment on the recent court case that ruled that his company is a monopoly, and has engaged in using that market force to protect itself from potential challengers. Instead, Gates said little or nothing about the case beyond asking the audience: "Has anyone heard any good lawyer jokes lately? It's great to know that all over America, there are entrepreneurs, working in their garages, and lawyers working in their 20th floor offices, both working at what they do best."

The centerpiece of Gates' speech was the demonstration of a new Microsoft Web appliance just for accessing the Internet. The device is part of a new class of 'Web Companion' systems. The Microsoft device is code-named 'Mariner', and is a textbook-size device that runs Microsoft's Windows CE software, and connects instantly to the Internet using Microsoft's MSN Internet service.

The device may include a keyboard, and would jump users directly to Microsoft's MSN site. It is expected that Internet Service providers will end up giving the device away free to customers who agree to sign up for one or more years of Internet access. The device will let users surf the Internet, send and receive e-mails and faxes, and keep an electronic calendar and address book.

"It's a new class of devices that will be a key component of our Web strategy", Gates said.

The Web Companion is among a new generation of personal digital assistants (PDAs), a class of products that, with the exception of the Palm Pilot from 3Com, has had a hard time gaining acceptance. But with the added wireless Internet and Web access the new PDAs are expected to quickly spread and proliferate.

The MSN-based Web Companion is expected to be available in the second half of 2000 and cost around US$200. They will be produced and sold by Acer, Philips Electronics, and Thomson Consumer Electronics. America Online is expected to launch a similar device in the coming months.

Gates also showed a humorous video, in which he was dressed as Austin Powers, in a blue velvet suit and lacy shirt, as the 'International Man of Technology', with president Steve Ballmer appearing as Dr. Evil.

In his speech, Gates also talked about how the Internet will move from a static model to a more interactive, personalised one, where users can access favourite Web sites to get exactly the information they

need, on a wide range of devices.

## HP on a mission

While Gates' speech was fairly light-hearted, Hewlett-Packard's new Chief Executive Carly Fiorina arrived in Las Vegas on a mission to light a fire under the company which has seen market opportunities go by because it has been too slow to respond.

Fiorina made it clear that she intends to "rock the boat" as she wants HP to transform itself from being re-active to pro-active and leveraging HP's tradition of invention and innovation. "We will be preserving the best and reinventing the rest. This is a company founded by two men who are pretty radical thinkers. Somehow, along the way, we stopped talking about invention. We're going to start talking about it again."

One of the first major inventions, she said, will be a joint venture with Switzerland's Swatch company to develop a Buck Rogers-like wristwatch that can access the Web.

*Carly Fiorina, CEO of Hewlett Packard wants to make the Internet pervasive, friendly, warm and personal. We wish her luck...*

Fiorina would not say when the product would be launched.

At the core of HP's new strategy is the Internet, and Fiorina's belief that unless the Internet changes from being "...cold and impersonal to become pervasive, friendly, warm and personal," it will not live up to its potential of creating an entire new global economy in the next decade. "We are at a critical juncture in the Net. Just a few years ago, when the Net really got going, you were either a Young Turk or part of the Old Guard. Now there has to be a balance between these two. HP will drive inventiveness for the new economy".

Fiorina unveiled a new $200 million marketing and advertising campaign that will emphasize the Palo Alto garage in which founders Bill Hewlett and Dave Packard turned out their first product. Its new logo will be 'HP: Invent'

The key to success in the future for HP and other companies will be the ability to deliver good services, along with good products. "Products become much more valuable when they are supported by services. This is the end of the product-only era. We have to think how to make profits with e-services."

## Linux: popular as ever

Linus Torvalds, the father of the Linux movement drew a packed audience in his keynote address in which he told over 7000 attendees that software, rather than hardware is moving to become the prevailing driver of technology. "Hardware is no longer being developed at the pace it was years ago. High-end hardware will innovate more slowly as devices and platforms shrink."

Linux, he said will increasingly become the operating system of choice in the booming market for Internet appliances because the software has virtually no cost, is highly scalable to any kind of device and is far more reliable than competing solutions.

The excitement surrounding the Linux movement was the first major attempt at an open rebellion in what has traditionally been a Windows love-fest since the Apple-Motorola-IBM alliance tried — and failed — to up-end the Wintel standard with their PowerPC architecture.

*Linux seemed to be the biggest thing going at Comdex, with over 75,000 people visiting the Linux Pavilion. No wonder Linus Torvolds is smiling.*

## Linus' 'chameleon' CPU

On January 19, Linus Torvalds is expected to make an announcement that could shake up the microprocessor market as much as his Linux operating system is uprooting the server and networking OS market.

During his keynote Comdex address, Torvalds revealed that Transmeta, a highly secretive Silicon Valley start-up that he has been working with for much of the past year, would make a key announcement regarding the 'smart' microprocessor it has been developing.

On January 19, Transmeta will be releasing a processor called the 'Crusoe', Torvalds said, adding he could not provide any further details. "We rethought the processor to create a whole new world of mobility." There has been a lot of speculation around the industry about what Torvalds and Transmeta are up to. It is expected that the Crusoe will compete with Intel's line of PC chips.

Reportedly, the Transmeta chip will run under control of a scaled-down implementation of the Linux operating software. That combination of circuitry and system software will reportedly enable the processor to mimic the functionality of other microprocessors, including the Pentium and Sun Sparc processor chips and thus run any of the software developed for those platforms.

Transmeta's founder David Ditzel is a former Sun Microsystems Sparc processor designer. "The idea is to make the chip almost chameleon-like in nature. It consumes a limited amount of power and it can mimic any processor out there".

"If you could mimic any processor, who would you want to mimic?" said one industry insider in the audience at the Torvalds speech. Others believe the Crusoe will be aimed at a new generation of Internet appliances.

Transmeta is funded, in part by Microsoft co-founder Paul Allen and has raised some $100 million in start-up capital.


In a move to change the character of Comdex, this year's show featured a number of vertical pavilions featuring a specific class of products or technology. By far the most successful and heavily attended was the Linux Business Pavilion where some 100 companies displayed hardware, software and networking products built around the Linux operating system, and an estimated 75,000 people visited the Linux Pavilion.

As a sign of how quickly Linux is developing as a viable alternative to Microsoft's Windows NT/2000, especially on the server side of the computing network architecture, next year's pavilion will be twice as large, and the space was all but sold-out by the end of the show. That cannot be said for the rest of Comdex, which is suffering from a rather dramatic decline in exhibitor participation.

## Sun bashes Gates

"Scott McNealy Doesn't Want Your Money," read the giant banner, which covered the entire side of the parking garage across the Las Vegas Convention Center. At least until the final day of Comdex, when someone pulled a prank and overnight covered up the letters 'n't' in 'doesn't.'

McNealy and his Sun Microsystems company have not had much of a presence at any previous Comdex show. McNealy raised a lot of eyebrows for stepping into the 'lion's den' with a heavy dose of anti-Microsoft messages and hype promoting Sun's StarOffice software suite which is available free from Sun's Web site. Sun also gave away tens of thousands of CDs with the StarOffice suite of business productivity applications for the Windows, Linux and Unix platforms.

McNealy gave a keynote address on the third day of Comdex in which he blasted Bill Gates and Microsoft in no uncertain terms and with a harshness that clearly brought out his deep resentment of Microsoft and its predatory business model. Even McNealy conceded the rather bitter nature of his demeanor. "This speech was supposed to be an example of a kinder, gentler Scott McNealy, but I guess not."

McNealy went on the attack against Microsoft saying O2K (Office 2000) and W2K (Windows 2000) pose a greater threat to the computer industry then Y2K. "Of the top 10 best-selling PC software programs, five are needed to undo or fix what you did with the other five." But McNealy also incorporated some humor into his comments regarding the competition. "I don't hate Windows PCs ... they keep people off the streets and off drugs."

On the other hand, Web appliances and machines running Java are infinitely simpler and that will drive their demand and popularity. "My 2-year-old can operate a set-top box. These new devices are so easy that you don't have to worry whether your kid is computer-literate ... unless they're sitting behind a Windows PC."

*Head of Sun Microsystems, Scott McNealy was getting a bit hot under the collar about a certain software company. He gave away tens of thousands of StarOffice CDs just to spite Bill, we're sure...*

McNealy said he wants the computer industry to follow the same model as in the telephone industry where consumers and business users don't know, or care what operating system runs the telephone. They just expect them to work. "We buy into the notion that information ought to be a utility that is just as easy to operate as water or power."

Unlike most keynote speakers, McNealy did address the Microsoft antitrust case and said he thinks Microsoft will be forced to break up. "If I were a betting person, I'd say they are going to break them up," To avoid that, the minimum requirements for a settlement would require Microsoft to agree to transparent pricing, be prevented from making exclusionary agreements, be forced to open up application programming interfaces, and be forbidden from investing its 'monopoly money' in intellectual property and in its customers. "All I want Microsoft to do with their monopoly cash is give it back to the shareholders or put it back into R&D and innovate for once in their life. I have said that if the government can't see Microsoft agreeing on these issues then maybe they've got to go structural," McNealy said referring to a forced breakup.

McNealy's anti-Microsoft vision was also preached in keynote speeches by the chief executives of the leading distributors of the Linux operating system. "No one buys operating systems. People buy applications. Our opportunity is to build the killer apps of the 21st century, not to re-invent them," said Red Hat CEO Robert Young.

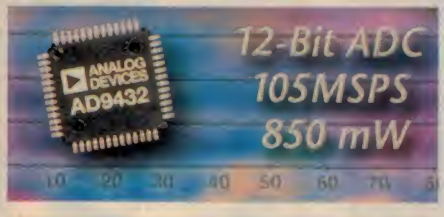
Caldera CEO Ransom Love added: "No single company should control a standard, and this is essential for the adoption of Linux (which is Open Source based). Microsoft's questionable business practices have caused a desire for alternatives. Linux plays as an application server, thin server, and soon as a specialized high-end server." Love said Caldera is targeting corporate IS managers, ISPs and value added resellers. ❖

# SOLID STATE Update

LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

## 12-bit 105MS/s ADC uses only 850mW

Analog Devices, Inc. has released the AD9432, a monolithic sampling 12-bit, 105MS/s analog-to-digital converter (ADC) with an on-chip reference and track-and-hold circuit that delivers a guaranteed 80dB spurious free dynamic range (SFDR) up to the Nyquist frequency – and draws an industry-leading 850mW. The encoder input supports either differential or single-ended signals, and the digital output features a separate output power supply pin that allows interfacing with +3.3V logic. Both the input and output are TTL- and CMOS-compatible.




Operating from a single +5V supply, the AD9432 requires no external components for many applications, which include base stations and 'Zero-IF' receiver subsystems, supporting a range of standards for CDMA, GSM and new 3G systems to GPS ant-jamming receivers, Local Multi-point Distribution Service (LMDS), Radio Links, phased array receivers, cable infrastructure, and other types of voice and data communications receivers. Additional applications include HDTV broadcast cameras, film scanners and instrumentation.

For more information contact Analog Devices, Suite 4/1621 Point Nepean Road, West Rosebud 3940.

with a wide variety of input power sources. The LT1762 and LT1763 can also operate with capacitors as small as 2.2uF and are stable using any capacitor type, including ceramic, tantalum, or aluminium electrolytic.

Output voltages are fixed at 2.5V, 3.3V and 5V or can be adjusted between 1.22V and 20V. For further information contact REC Electronics, Unit 1, 38 South Street, Rydalmere NSW 2116.

## Power MOSFET chip set for DC/DC converters

A power MOSFET chip set that greatly improves the efficiency of DC-to-DC conversion circuits in notebook PCs has been released by Vishay Intertechnology. Consisting of devices that are individually optimized for switching and synchronous rectification functions – as performed by the two MOSFETs in a DC-to-DC circuit – the new chip set works with popular controller ICs from Vishay Siliconix and other suppliers to deliver improvements in efficiency on the order of 5% compared with previous state-of-the-art power MOSFET devices.

The chip set consists of the Si4874DY, a 7.5mΩ device with 35nC gate charge, and the Si4884DY, a 10.5mΩ device with 15.3nC gate charge. The Si4874DY provides the low on-resistance required for the bottom freewheeling MOSFET, which carries the current for the majority of the time, and is designed to withstand fast switching transients. For the upper MOSFET slot in the same circuit, the Si4884DY provides the fast switching times that are critical for the switching FET role, with a lower level of gate charge that is ideally suited to the shorter duty cycle of the upper position.

The product of gate charge multiplied by on-resistance provides a general figure of merit for devices that will be used for switching at high frequencies. For this new chip set, this figure is 252 for the Si4884DY, a record for any device with comparable specifications. In a converter with a 15A output and a Vout of 2V – which will be typical requirements for powering the next generation of microprocessors – this chip set delivers 83% efficiency, and 95% at 3A output.

For more information contact Vishay Intertechnology Inc., 63 Lincoln Highway, Malvern PA 19355-2120 USA, or visit www.siliconix.com. ❖

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## BONUS OFFER

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Can be configured to trigger a VCR to record an intruder's movements!

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## 30 Range DMM WITH TEMPERATURE

• -50°C to 1100°C Temp.
• Data Hold
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• Continuity Buzzer
• AC/DC Current < 200µA - 10A
• Diode Check

Q 1103 Thermocouple $15

SAVE
Q 1102 Was $109
SPECIAL $89

## Learning UHF Remote Control

Why pay up to $48 elsewhere ?

This miniature intelligent learning remote control can be used as a replacement for your car remote control or to combine more than one remote. ie. Garage door, car, motorbike, home alarm, etc. Very simple to program, just copy the code from your existing remote control.

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SAVE $$
A 1015 Was $39.95
NOW $35

This remote can be programmed to control two car alarms. Ideal for 2 car families!

## Programmable Remote Control

Very simple to program and operate. Replaces up to eight remote controls plus adds up to 20 one-touch macro functions for armchair comfort. **Features:** • 10 Different Appliance Modes with 47 functions per appliance • Smart backlighting (light sensor equipped)


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## 5 Port USB Hub

This tiny 5 port desk mount HUB is suitable for connecting all your peripherals. For instance modems, printers, keyboards, mice, CD ROMs, Scanners, etc. The HUB requires no external power and has 1 "upstream" output to connect to your computer and 5 "downstream" inputs for device connections.


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D 4500 Was $129
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Converts 24V DC to 13.8V DC for use with stereos, CB radios, two ways etc. Ideal for trucks, boats, tractors etc.

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M 8162 Was $69
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This handy little keychain unit is ideal for lectures, seminars, building sites, guided tours.

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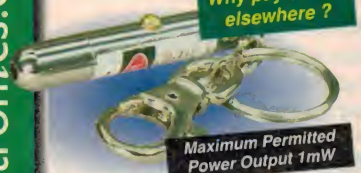

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Includes a FREE set of extra batteries! (RRP $4.50 Value)

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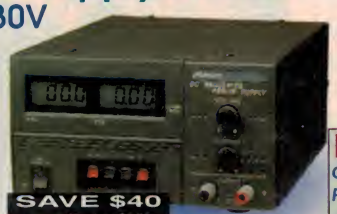
## Power Supply for Life! 0 to 30V @ 5A

A lab supply with a main output rail adjustable from 0 to 30V, at up to 5A.



SAVE $40
M 8205 Was $329
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Features: • Separate controls for voltage and current limiting • Fixed 12V and 5V output rails, at up to 0.5Amps • Precision digital LCD Voltage and Current Meters for fine adjustment for use in research labs, instrumentation testing, digital circuits, etc.

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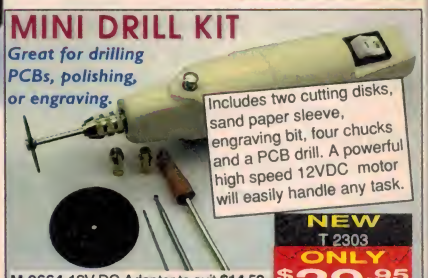
Great for drilling PCBs, polishing, or engraving.



Includes two cutting disks, sand paper sleeve, engraving bit, four chucks and a PCB drill. A powerful high speed 12VDC motor will easily handle any task.

M 9664 12V DC Adaptor to suit $14.50

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Features: • Powerful 120mm fan (95/115 CFM) • Swivel Adjustment to easily angle unit to the job • On/Off Switch • Filter simply un-clips for cleaning • 240V Operation • ESD Safe

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The first 50 callers will receive a Large 55 x 30cm Anti-Static Mat & Wrist Strap ABSOLUTELY **FREE!!** (Valued at $19.95)

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This 3.5 digit multimeter is perfect for the budding enthusiast or student. Featuring an in-built hfe transistor tester, it offers many functions of much more expensive models. Measures DCV to 1000V, DC Amps to 10A, ACV to 750V, resistance to 2MΩ. It even includes a diode tester!

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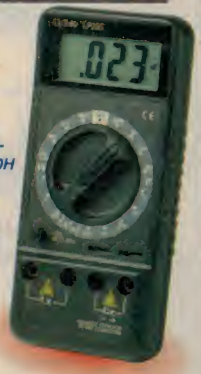

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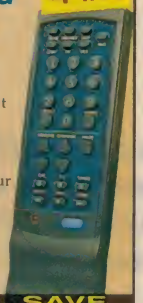

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*If you have two computer and only one printer, this little gadget will allow either computer to print to the printer without touching any cables!*

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This 3.5 digit LCD voltmeter will add style to any project. 200mV, 2,20,200 and 1000V DC ranges and decimal place options are easily set by PCB links. Compact, reliable and includes a plastic surround for a professional finish. Requires 9V DC supply.

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# Diamond Cut's *Millennium*

**The new Millennium edition of Diamond Cut's 32-bit Audio Restoration Tools package offers an impressive range of powerful and enhanced features for restoring audio files. Here's a hands-on report...**

*by Jim Rowe*


IN THE BARE 12 months since I reviewed the 16-bit version of DC-Art for our January 1999 issue, Diamond Cut Productions has made some very significant functional enhancements to the package. First it became a full 32-bit version, to provide faster operation on systems running Windows 95/98 and NT, with some extra capabilities like 'virtual valve sound' and automatic detection of track gaps thrown in. Now with the release of the new Millennium edition, it's been further enhanced with a raft of extra bells and whistles including an improved impulse noise filter, more tools for 'forensic' sound reclamation and the ability to run multiple filters simultaneously.

Diamond Cut, you may recall, is a New Jersey firm established in 1992 by Craig Maier and Rick Carlson — a couple of engineers with a passion for restoring early recordings. When they couldn't find digital audio restoration software that met their own needs, they developed their own. It turned out to work so well, and to be so user friendly, that they were motivated to market the software in its own right: as DC-Art.

The new Millennium edition of DC-Art certainly offers a lot of goodies. For a start, it now supports files with 8, 16, 20 or 24-bit samples, and sampling rates up to 96kHz (assuming your sound card can handle these sample resolutions and rates), and can perform conversions between these formats. As well it can now also open MP3 compressed audio files, converting them to standard uncompressed WAV format to allow all of its filtering and editing operations to be carried out.

There have been quite a few enhancements to the various restoration filters, too. For example the impulse noise filter toolbox — already very flexible even in the original 16-bit version — now provides an additional HQ option, where the 'HQ' apparently stands for Hind Quaternion mode. This seems to be a very powerful filter for detection/restoration of both impulse noise and clipping distortion (especially for vinyl recordings), while at the same time being a little easier to adjust in terms of its detection parameters. This makes it easier to set for efficient click detection sensitivity, while still ensuring that legitimate musical transients are untouched.

The FFT-based continuous noise filter now offers variable spectral resolution, to allow easier 'fine tuning' for the best compromise between noise reduction and transient response. As before you still have control over parameters like attack, release and attenuation, and easy graphical control over the frequency characteristic.

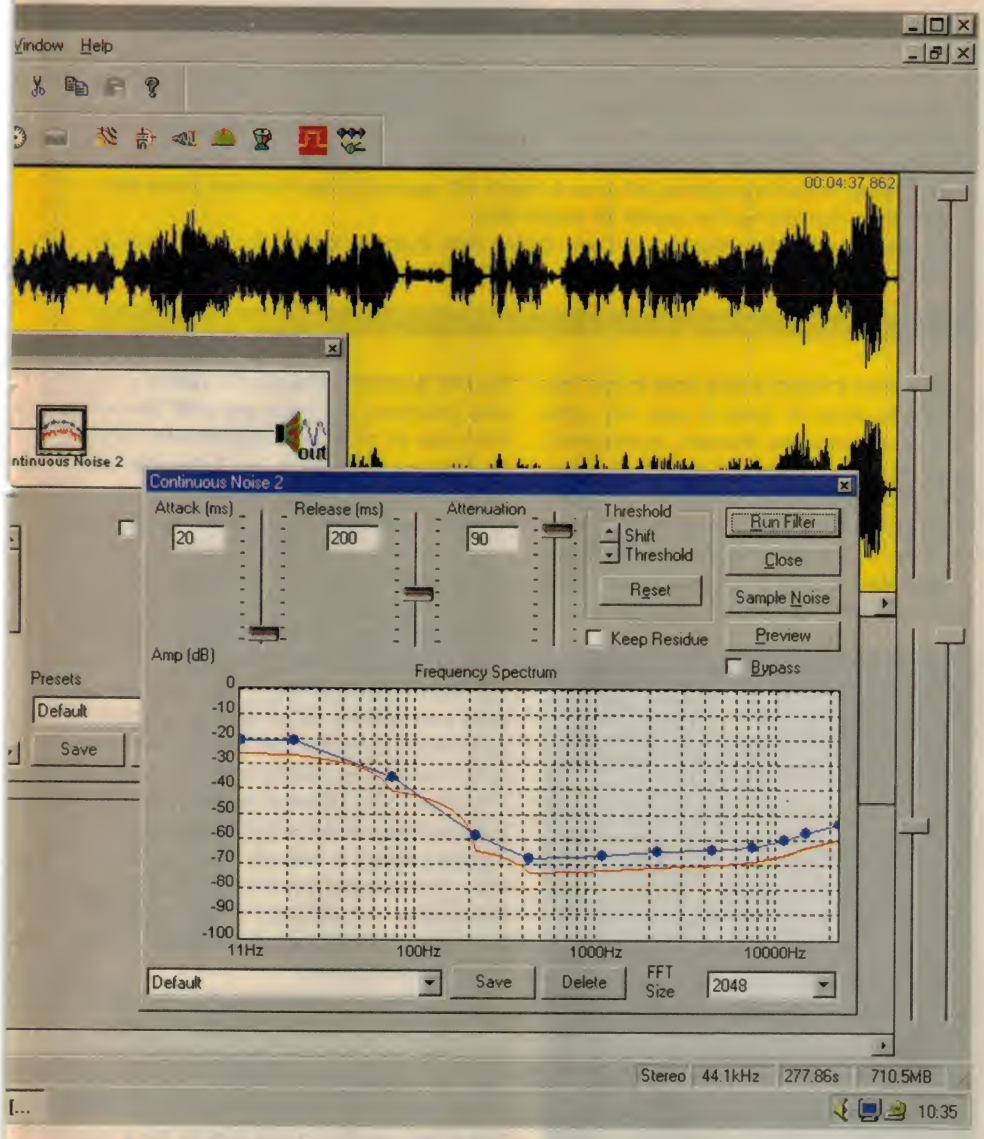
As before there's still a separate Dynamic Noise Filter, which simulates the action of a traditional analog-type dynamic LP noise filter. There's also fixed low pass, high pass, bandpass, median, average, notch/slot and harmonic reject filters.

All filters have a preview mode, so you can monitor their effect on a sample of your file before the actual filter run. For greater convenience there's now also a 'Multi Filter' mode, where you can cascade up to 10 filters or effects and have them used to process a file automatically. This actually has advantages over separate filter runs, as it prevents an accumulation of quantisation errors.

In addition you also have the ability to create (and edit) batch files, so you can set up DC Millennium to run the same filter or Multi Filter sequence on a batch of multiple wave files, while you go off and do something else...

By the way, in addition to the 10-band Graphic Equaliser found on the original 16-bit version of DC-Art, the new package also provides a Paragraphic Equaliser — with anywhere between one and 10 bands, each adjustable in terms of centre frequency, bandwidth/Q and gain/attenuation. There's even a choice of preset equalisation 'recipes' useful for audio restoration work, like RIAA, inverse RIAA and NAB.

Quite apart from these filtering tools, the package has also been enhanced in what might be called its *effects* toolbox. For example the digital reverb effect has been improved, mainly by the addition of a number of 'descriptive presets'. There are now some 27 of these




*A nice feature of DC Millennium is the ability to assemble your own custom 'Multi Filter' sequences, to apply various filters in succession while a file remains in the digital domain. Each filter in the sequence is set up graphically, as you can see.*

preset reverb 'recipes', varying from 'Large Cathedral' down to 'Small Wood Room'.

The 'Virtual Valve Amplifier' (VVA) effect can now produce a variety of effects ranging from subtle 'tube warmth' through to more obvious distortion like 'guitar amp overload' and 'fuzz box'. The VVA has quite a few adjustable parameters, including the ability to select the type of valve synthesised (like 12AX7, 12AU7, 6EJ7, etc), operating point, drive level, mixing level and so on. As with reverb there are quite a few preset recipes to provide you with starting points.

There's also a Dynamics Processor, which provides three functions for adjusting the dynamic range of an audio signal: a downward expander, an upward compressor and a 'de-esser' which can reduce the frequency components associated with over-close vocal miking. The expander and compressor functions are fully adjustable in terms of their operating parameters.

Other handy effects include file speed changing, which can be either constant in action (allowing you to restore to correct speed a 78rpm or 80rpm disc recorded at 45rpm or 33.3rpm, for example) or dynamic, for correcting localised speed variations. This latter function can be graphically programmed, to act over as much or as little of the file as you wish.

There's also an enhanced spectrum analyser function, with variable resolution, and an X-Y vector display which allows you to see the phase relationship between the signals on the two stereo channels. This can be used in conjunction with a Time Offset function, to monitor and correct for differential delays caused by tape azimuth errors, etc.

Other nice file manipulation functions now available include the ability to reverse a file end-to-end (which can make impulse filtering either easier to set or more effective), to swap stereo channels (stereo reverse), to reverse the phasing of one or the other stereo channel, to blend stereo channels into mono, and to drop markers into a file and move them in position. (The markers can be saved with the file.)

Yet another area in which DC Millennium has been enhanced is the addition of new functions dedicated to 'audio forensics' — retrieving information from very noisy signals derived from surveillance or safety monitoring recordings. These are essentially specialised 'brute force' filters, designed purely for 'scraping signals out of the noise' rather than maintaining or restoring signal quality from a hifi viewpoint.

The two options here are a set of 'brick wall' filters with very steep slopes and high rejection of out-of-band signals, and an adaptive filter which adjusts itself to remove a modelled noise or interference signal (ideally a separate reference signal containing the noise to be subtracted from the desired signal). A time-delayed version of the signal itself can be used as the reference.

There's also a new set of 'CD Prep' tools, for preparing wave files before recording them on CD-Rs. These include Gain Normalise, which searches through a file to find the peak signal level and then applies a gain correction to the file to provide the best signal to noise ratio; Find & Mark Silent Passages, which essentially finds and marks the track breaks if you've recorded an entire LP side to a single wave file; Quantise for CD Audio, which moves the markers to multiples of 2352 bytes, for glitchless CD indexing; and Chop File into Pieces, which uses the markers to break a large file into smaller 'separate track' files.

By the way DC Millennium also has an improved dialog box for recording wave files from incoming audio, with more options, easier

## Special Offer to EA readers

As a special offer to Electronics Australia readers, Diamond Cut's local distributor Multimedia'n'Music is currently offering the DC Millennium package at the price of only $445 (a discount of $50). The offer includes FREE delivery anywhere in Australia — all you have to do is you mention this review when you order via their freecall hotline, on 1-800-64-6434.

setting of parameters and easier to read on-screen 'LED level meters'. There's also a clear indication of remaining hard disk capacity, in terms of recording time. (You can of course use other software to record your files if you prefer.)

Other nice features include an improved 'Make Waves' function for generating sinewave, squarewave and noise signal files for testing; and the ability to print out turntable speed checking stroboscope discs, for either 50Hz or 60Hz mains lighting.

In short then, the Millennium version of DC-Art now sports a very impressive range of features and functions — with just about everything needed for recording audio files from a variety of sources, restoring their quality, editing them and preparing them for digital recording on CD-R discs.

About the only thing missing is the ability to do filtering and restoration of audio in real time — and Diamond Cut is actually now offering that further step, in another version again called Diamond Cut Live (at over three times the price, though).

## What we found

Thanks to Diamond Cut's Australian distributor Multimedia'n'Music, I've been able to try out a copy of DC Millennium over the last few weeks. I installed it on the same 266MHz Pentium II/NT4 system that I've been using to run the original 16-bit version of DC-Art, so a direct comparison was possible. It's been very interesting too, because until now I haven't had a chance to try any 32-bit version of DC-Art.

I've now used the new version to record and restore audio from a number of older LPs, and prepare them for transfer to CD-R. And up front, I should note that I've been very impressed — both with the package's improved ease of use, and the enhanced performance from many of its most useful filters and effects.

For example whereas I previously preferred to use another package for actually recording the audio to hard disk, I've found Millennium's enhanced function and dialog so much easier to use that I haven't wanted to. And now there's a file reversing function built in, you don't have to fire up another package to do that little chore either.

I've also been very impressed with the Impulse Filter's new HQ mode, which seems to make it a lot easier to find the optimum balance between click removal and minimum disturbance to music transients. And the improvements to the continuous noise filter, and all of the preset 'recipes' for so many of the filters and functions.

The new CD Prep functions are also very handy, although here's where I'd like to make my first little criticisms. These concern the operation of the 'Find & Mark Silent Passages' and 'Chop File into Pieces' functions.

## Diamond Cut Millennium

A 32-bit package for recording mono/stereo audio to hard disc, applying powerful digital restoration filters and other tools, and preparing for recording to CD-Rs.

Good Points: Improved impulse noise filtering; powerful Multi Filter function; ability to handle and convert up to 24-bit/96kSa/s files; many new features.

Weak Points: A few minor glitches still present, mainly with regard to screen waveform display files.

RRP: $495 (but see box for special EA reader offer)

Available: Multimedia'n Music, 145 Como Parade East, Parkdale Vic (PO Box 550, Braeside 3195). Phone (03) 9587 6910 or visit www.multimedia-music.com.au.

Point one: I found it very hard to get the former function to drop in just the right number of numbered markers, corresponding to the right number of individual tracks when I'd recorded a complete LP side. Generally it seemed to drop in too many markers, or put them in the wrong places — sometimes even in jumbled order! As a result, I eventually gave up and began dropping the markers in manually...


*The box cover suggests some of the many uses for this powerful 'audio massaging' package...*

Even doing this, though, another odd effect became apparent: when you do have the markers set correctly, and fire up the 'Chop File' function to break your big file up into the smaller track files, it certainly does so — but they seem to be created and numbered in reverse order. So the first marked section becomes the small track file with the last derived number, and vice-versa.

This isn't serious, of course, but it's a bit counter-intuitive and irritating, to say the least. The files in your CD track list all look as if they're in reverse order.

I also found that although you can select the option of not retaining the original large WAV file (to save hard disk space) when you produce the smaller track files from it, DC Millennium still seems to retain the matching PKF waveform display file (which it creates whenever you open any WAV file) and keep this on the screen (underneath those for the new track files), as if that file still existed. A bit confusing, again.

There's another little irritation regarding the on-screen waveform displays, too. I like using the manual 'paste interpolate' function, to remove each of the small number of really big clicks that often seem present in transfers from LP — before I run the main impulse filter. This seemed to work well with the 16-bit version, and basically with Millennium too. However with the latter the screen display sometimes doesn't seem to be updated properly, to show you how the waveform has been 'restored'. The nett result is that on these occasions the interpolation doesn't seem to have been done — although it generally has been, as you find if you try listening to the passage concerned.

This failure to update the PKF waveform display file also seems to happen occasionally when you run the impulse filter itself, too. A couple of times I found the 'Destination' file display still showing all of the spikes visible in the source file's display, even though the filter had actually removed most of the clicks concerned. So I'm pretty sure it's a bug.

My only other gripe about DC Millennium is that the user manual now seems to be a bit patchy and unhelpful in places. Some of the features and functions don't seem to be properly listed in the index, and in any case you often seem to have to jump back and forth in the manual to find the information you want. In short, the manual now seems to be in need of a fairly major update and revamp.

On the other hand the context-sensitive help facility in the package itself is up to date and helpful, so you can argue that the printed manual is a bit redundant anyway.

Overall I have to admit that despite these criticisms, Diamond Cut Millennium really is an excellent package for audio file recording and restoration. It now does just about everything you need, and is still surprisingly easy to drive. If they can fix those few remaining glitches, it'll be superb. ❖

# Keeping in Touch

## with Australian Touchscreen Technology

***Simple and effective, touchscreens are an easy way to interface with practically any computerised system. Australian company APC Technology has recently devised a new, more effective touchscreen that gives higher resolution, and at a lower cost too.***

If you're looking for a simple, intuitive user interface for a public data terminal, touchscreens are usually the way to go. Touchscreens are often the preferred form of computer interface for use in difficult and hazardous situations, particually where durability is paramount.

Situations in industrial, mining, public access and defence environments, often call for a simple, user friendly and (perhaps most importantly) unbreakable interface. Australian APC Technology has a keen interest in touchscreens, and have come up with a new system that offers increased resolution and greater reliability.The first generation of infrared touchscreens has been around for many years, and is widely used in industrial situations.

It uses two perpendicular arrays of IR beams and is a medium cost solution, with its main disadvantage being limited resolution. and parallax error when used on the curved surface of a CRT. While simple and straightforward, this first generation system has the inherent advantages of being suitable for use with glass of any thickness, and absolute position sensing with no calibration required.

### Infra-T

Over the past 6-7 years, APC Technology has implemented most of the available touchscreen technologies in Australia. The shortcomings of the various technoogies led to the development of the Infra-T touchscreen.

The Infra-T is a new technology that overcomes several weaknesses in first generation infrared systems. The improvements over existing infrared technology include vastly improved resolution and reduction of susceptibility to ambient light, as well as immunity to unplanned interruptions — such as insects breaking the IR beam.

With Infra-T, each infrared beam is generated by a transmitter and passed through a lens. This lens opens the beam up so that the beam covers the entire area of the transmitter receiver segment, effectivly projecting a wide stripe of IR across the screen.

At the receiving end the reverse happens and the beam is focussed on the receiver, with the signal from the receiver processed through an A/D converter. Partial obstruction of the beams will reduce the amount of IR received, and help indicate the exact centre of the obstructing object.

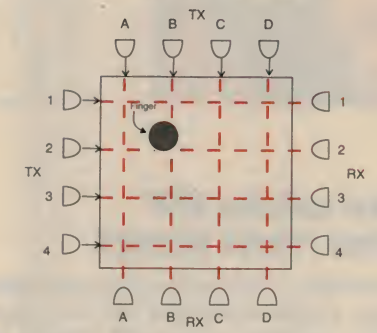
If the Infra-T array scans and finds an obstruction (a fingertip, for example), the obstruction pattern for segments around the finger would look like the lower diagram, which shows how the precise position of the obstruction can be determined from the amount of obstruction in each IR stripe.

Suppliers of other touchscreen technologies claim that infrared systems can be triggered by an insect (such as a fly), moving across or landing on the screen. However, tests at APC have found this to be untrue - they've tested Infra-T with both live and dead flies and neither have triggered the touchscreen!

For harsh environments or applications where the touchscreen is subject to abuse, a number of technologies can be used — capacitance, acoustic and infrared are all contenders, but if the display is flat, infrared provides a robust solution with high resolution and zero attenuation, at a lower cost.

For further information goto **www.apctechnology.com.au**

CONVENTIONAL INFRA RED

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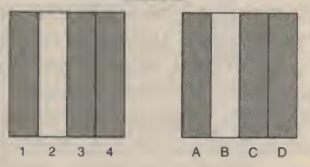


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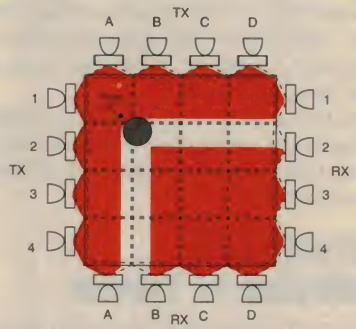


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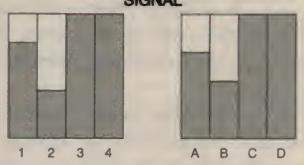



### Software

Of course, the full advantages of Infra-T can only be realised with the appropriate software driver in the PC. This driver communicates with the microcontroller in the touchscreen which performs a degree of pre-processing.

The Infra-T driver has three modes of operation: - Single Finger Mode, Drag Model and Intellimode.

In Single Finger Mode the cursor simply tracks the finger and events are generated when the finger enters the IR array. This is a basic interface mode and one that is normally used in public access terminals, where untrained casual ussers are the norm.

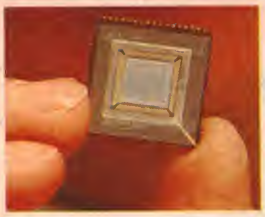
Drag Mode is available for special applications that require dragging of icons and windows across the screen.

Intellimode provides a number of significant advantages, with features including:

Two Finger Mode: This enables a cursor to be precisely positioned with one finger and event clicks generated with a second finger.

Offset Mode: It can be difficult to use a finger to precisely position the cursor because your finger obstructs the view of the target. The offset mode enables the user to offset the cursor approx 20mm away from the finger. The offset stays in place until the finger in removed from the array.

Auto Drag: When a finger is dropped on top of a Windows box, the drag mode is automatically enabled and the box can be moved.



# Silicon Valley Newsletter

## New cellular DSP gives 'world phones'

MOTOROLA HAS announced a new digital signal processor chip that will let a single cellular telephone operate with virtually any wireless telephone system standard used around the world. The DSP56690 processor supports the global system for mobile communications (GSM) which is used widely in Europe, code-division multiple access (CDMA), the integrated digital enhanced network (IDEN) and the time division multiple access (TDMA), as well as newer satellite-based formats.

"No other semiconductor manufacturer in the world offers one baseband processor that can handle all of the world's cellular standards", said Mario Rivas, general manager of Motorola's wireless subscriber systems group in Austin, Texas.

The new chip will go into full-scale production in the first quarter and the first telephones build around the chip will hit stores by next summer.

## NEC shifts PC production to Taiwan

FORCED TO REDUCE production costs in an increasingly competitive domestic PC market, NEC is shifting about half its annual production of three million PCs from company plants in Japan to contract manufacturers in Taiwan.

Previously, NEC has moved production of key notebook components to Taiwan. It is now expanding that to include production of desktop models. The first Taiwan-produced NEC PCs will hit the Japanese market this coming spring.

## ABN-AMRO sees $300B chip market in 2002

DAVID WU, A CHIP industry analyst for Dutch banking and finance institution ABN-AMRO, has predicted the global semiconductor industry to grow by 25% in 2000 and 31% in 2001, before starting a cyclical decline in 2003.

"We believe the semiconductor industry is just past the first anniversary of a four-year cyclical upswing that will peak at US$300 billion in 2002 from the 1998 trough year at $126 billion and the initial recovery year 1999 at $144 billion", Wu said. "Growth should accelerate from 15% in 1999 to 25% in 2000, peaking at 31% in 2001 and 28% in 2002. A cyclical decline should begin in 2003 as over-investment in 2001/2002 would cause pricing to be under pressure, more than offsetting positive unit volume growth."

Wu said the most attractive sectors for growth were those that sell to the wireless and Internet infrastructure providers, including Texas Instruments, Analog, National Semiconductor, Maxim Integrated Products, Linear Technology, Xilinx and Altera.

In DRAMs recent under-investment will lead to under capacity in 2000/2001 and higher memory chip prices. Micron Technology in the US and Samsung are likely to reap in the bulk of additional profits from DRAM chip shortages.

## S3 & Via form graphics chip alliance

GOING UP AGAINST Intel in a key IC market is a challenge few companies take on. But that is just what graphics chipmaker S3, located almost next door to Intel in Santa Clara, and Taiwan's Via Technologies have announced they will do. The two companies said they have formed a new joint venture, S3-Via and the unit has already begun showing and selling potential customers their new integrated high-end graphics chip sets.

S3-Via's chip sets combine S3's highly acclaimed 'Savage 4' graphics IC with Via's top-of-the line PC chip set, thus lowering the overall cost of a PC and making its design more compact.

Analysts said the S3-Via product appears a potentially formidable competitor for Intel's graphics chip sets, as they are less costly and offer higher performance.

## Cisco buys wireless LAN firm

CISCO SYSTEMS HAS bought itself a strong market position in the still small but rapidly growing area of wireless local area networking (LAN), with the US$800 million stock-based purchase of Aironet Wireless Communications of Akron, Ohio.

Aironet's products allow portable computing devices, from notebooks to handheld devices, to transmits data at up to 11 megabits per second. Aironet's principal competitor in the market for wireless local area networking systems is Proxim. Analysts said a purchase of Proxim by either Lucent Technologies or Nortel Networks, two of Cisco's fiercest rivals, is an almost certainty in the near future.

Aironet, like the Cerent company Cisco recently acquired for a whopping US$7 billion, is still a very small company. Founded in 1993, it had sales of just $15 million in the more recent quarter. The firm earned just under $1 million. But like Cerent, Aironet


*Massachusetts firm MicroOptical Corporation has been awarded the 'Best of What's New' Award by venerable US magazine Popular Science, for this 'Invisible Monitor' clip-on display for spectacles. Currently it provides a 320 x 240 pixel 16-colour display, occupying about 10 degrees of the wearer's field of view. The company has higher resolution versions under development, as well as models where the display and its electronics are fully integrated with the spectacle frames. You can find more information on their website: www.microoptical-corp.com (Business Wire photo)*

owns a potentially critical piece of the merging computer networking and telecommunication technology puzzle. And companies like Cisco are willing to part with a sizeable portion of heir stock in order to obtain the technology.

Wireless LANs are predicted to become a larger market in the next five years with workers using wireless devices throughout a corporate campus. Already, users of wireless LANs include big-name companies, like Ford Motor, Walt Disney, Microsoft, Hewlett-Packard and Sears, Roebuck, all of whom are Aironet customers.

Aironet will become part of Cisco's desktop switching business unit, but its 131 workers will remain located in Ohio.

## TI licenses ARM's DSP technology

TEXAS INSTRUMENTS and ARM Holdings have announced plans to combine their respective expertise in digital signal processor and RISC-based microprocessor design to develop a new generation of ICs for mobile phones and small wireless computers with Internet access. As part of the deal, Texas Instruments will license ARM's latest ARM10T processor design.

The deal is significant for TI, which is facing mounting competition from Motorola, IBM, Intel and others zeroing in on the DSP market. ARM technology would enable TI to make its chips smaller, faster and less power-consuming — the main three ingredients that spell competitive advantage and profitability in the semiconductor market.

TI and ARM have worked together on wireless technologies since 1993. "This new agreement demonstrates TI's continuous committment to the ARM architecture for the development of leading-edge wireless communications,'' said Gilles Delfassy, VP in the semiconductor unit at Dallas-based Texas Instruments.

## LG-Philips files new suit against NEC

LG PHILIPS LCD, the joint venture of South Korea's LG Electronics and Royal Philips Electronics of the Netherlands, has filed a second LCD patent infringement lawsuit against Japan's NEC, along with NEC's Packard Bell computer group and three other US-based subsidiaries.

In the case, NEC is accused of infringing on four specific LCD flat panel display patents. Another set of four LCD-related patents are the subject of the earlier case. In both cases, LG Philips LCD is asking for a jury verdict on its infringement claim as well as monetary damages.

Separately, LG Philips LCD announced plans to invest more than US$1 billion in production facilities. Output from the plants will generate $2.4 billion in new revenue during 2000. ❖

## Looking ahead — a bright high tech future?

DURING THE PAST three years, an incredible number of new computer (hardware and software), networking, consumer electronics and communications technologies and standards have emerged, and all are pushing hard right now for market acceptance. While it is too early to pick the winners and losers, some new technologies, products and markets are clearly heading towards Main Street.

One thing that's least difficult to predict is that the Internet is going to be huge, everywhere, no matter what. The impact of the Internet on the global village it is creating is getting bigger with each percentage point of penetration of the personal computer in the consumer/home market. In the United States, PC penetration in the home has reached the 50% level. In most metropolitan areas this is closer to 60% and in Silicon Valley about 85% of households have at least one personal computer — generally two or three.

While elsewhere in the world the level of penetration is still ramping up, by 2005 the majority of households in the industrialized world will have Internet access and most countries will have transformed into the kind of dot-com-oriented society America has already become. The Internet is clearly the 'killer application' the computer industry has been looking for to draw in the bulk of mankind.

The demand for PCs and other end-user products that can hook up to the Internet will provide the resources needed for continued enhancement of basic PC building block technologies, such as semiconductor and data storage devices.

Barring severe financial problems, the semiconductor industry will be able to make it through the next decade at pretty much the same Moore's Law performance improvement ratio it has demonstrated during the past 30 years. The chip industry is entering the new Millennium only one year into its latest growth cycle, which is expected to last at least three more years. Most of the technologies, production techniques and tools are already in place to produce microprocessors with 20-50GHz performance, which can be expected by the end of the first decade. And DRAM memory chips with 64-256 gigabit capacity are quite conceivable using extensions of current technologies and tools.

By 2006 or so a significant portion of the population will carry a Web appliance of some sort. The integration of various computer, communications and entertainment functions into one Web appliance would represent a natural migration for this class of products as consumers are likely to resist having to carry more than two systems. Eventually, a single Web appliance will be able to offer both phone, paging, surfing, e-mail, calendar and other functions all in one wireless device. All of this will further drive demand in the system-on-a-chip market which will probably balloon into the next multi-billion IC sector.

What about the technologies that everyone expects to do well in the coming decade, but which may not evolve much at all? Probably one is virtual reality. Already a decade has gone by since the first generation of VR headsets became available for consumers. But overall the response has been disappointing.

Voice recognition is another area where the market has been slow to respond to what amounts to some spectacular technology developments. But voice-operated computers, as a standard system feature, are still way out on the horizon. Most people have only limited use for such convenience. The same goes for video phone calls. The technology is here but the demand is not. Most people are far more comfortable and effective during a business or social call when just talking on the telephone than when also being seen.

The computerized home will probably also remain an illusion for some time to come. Technology for home automation and remote control has been around for much of the past decade. The reality is that most people don't want to go through all the trouble of learning how to set it up, control and use it. And after a hard day's work, who wants to put up with problems in the home network, add visiting Uncle Louis and Aunt Amy as 'clients' to the file and mail server and get them a password to access anything from the toaster to the front door?

People will settle for a better television picture and HDTV will likely become a standard in most homes in the latter part of the decade. So will recordable DVDs, assuming the industry doesn't incorporate too many limiting restrictions.

Like the Internet itself, which really is still in the early stages of development, most areas of technology are still racing ahead or just getting out of the starting gates. If anything the next 10 years will bring an almost overwhelming barrage of new products, technologies and choices for consumers and businesses alike.

If you've been amazed at the progress we've seen since 1990, you just probably ain't seen nothing yet!

*Paul Swart*

# MARKETPLACE

## FOR SALE

DIY PCBs: **Video Memory from $39** * QUAD 4 Pix 1 Screen Time / Date from $149 * **Video TX/RX from $149** * VIDEO TRANSMITTER / RECEIVER System $199 * **IR Remote Control Extender Set $69** * FREE DIGITAL PC VIDEO RECORDER - TIME LAPSE - MOTION DETECTION Software with 4 Ch Capture Card from $113 * **concealed PINHOLE Mono or DSP COLOUR Camera, Microphone & Timer/Controller in PIR DETECTOR from $139** * BULLET 480 Line 0.05 lux SONY CCD or DSP COLOUR from $132 ***QUADS 4 Pix 1 screen from $256 HI-RES better than SUPER-VHS Quality** * PCB Modules from $76 COLOUR Pinhole from $155 * **MINI CAMERAS 36 x 36 from $85 - SONY CCD $102 - COLOUR $162** *DOME CAMERAS from $88 - SONY CCD $107 - COLOUR $164 * **Video BALUNS from $7** * DIY PAKS: 4 Cameras, Switcher & Supply from $499 - with 12" Monitor from $582 * **4 COLOUR CAMERAS, SWITCHER & POWER SUPPLY from $807 - with COLOUR QUAD 4 Pix 1 Screen from $1211** * COLOUR QUADS from $512 * **COLOUR DUPLEX MUX from $1329** * 14" MONITORS from $203 - with Inbuilt 4 Ch SWITCHER from $236 * **SEE-in-the DARK CAMERAS & INFRARED 50 x 120 mW LED ILLUMINATOR Kits from $19** * FULL RANGE ***DISCOUNTS** * Ask for our Catalogue & New Enquiry Offer * **www.allthings.com.au** * T 08 9349 9413

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## Electronic Bushwalking

*(Continued from page 21)*

readout of our altitude. We were also able to use it to identify other mountains since we'd programmed a few interesting peaks into the GPS as individual waypoints (markers), derived from the map in the computer.

Mt. Zion was a real test for the GPS. But on other trips it has worked somewhat better in forest, and beautifully in open areas above the tree-line.

### Get your own!

If all this sounds too good to resist, you'll have no problem getting into GPS in Australia. Most of the main brands such as Magellan are available locally. I've learned from an internet newsgroup that the Garmin 12XL is available from Whitworth Marine in Melbourne for $499. People are also buying them from the USA over the internet, but with the 12XL there is one problem: the city database is for USA cities. There is also a South Pacific city database, but the only way you can get it is to buy the GPS in the South Pacific area. There is no way to change databases after purchase.

An interesting possibility in Australia and New Zealand is a program called Ozi Explorer, made in Oz but in use all over the world. You can import almost any digitally scanned maps into Ozi Explorer, place some calibration marks on them, and then use them with a GPS just like Terrain Navigator does.

Although I was not able to obtain the full version of Ozi Explorer, I did manage to export a map of my home town of Port Townsend out of Terrain Navigator and transfer it into an OzExplorer demo version. I then downloaded a track log from my GPS and it displayed correctly on Ozi Explorer. It does look promising. You can check out Ozi Explorer on the web at **http://www.powerup.com.au/~lornew/ozi-exp.html.**❖

## Forum

*(Continued from page 56)*

*All that aside, I then had a German acquaintance tell me that he'd been told that CE marking was a purely voluntary scheme with no obligation to display a CE mark whatsoever. He even passed on the interesting piece of information that CE stickers are available in German stores for sticking on to equipment! When I stopped to think about it, I realized that I have actually seen such stickers on some equipment sold in shops here.*

*So, which interpretation of CE marking does one believe? It would be interesting to hear which versions of the 'story' are around in Australia. The whole mess of confusion is giving rise to undue expense and trouble for some manufacturers, and the ridiculous state of affairs where we are seeing CE marks applied to some completely inappropriate objects. I seem to recall a letter from an EA reader some months ago telling how a new book (published in Britain) had a CE mark on its cover!*

*I would strongly urge Australia to completely ignore the whole European standards fiasco, if it were not for the fact that you probably need to export to Europe in order to remain competitive.*

*To conclude, I have investigated a little further regarding what I was told by my German acquaintance, who thought that the CE mark was voluntary. It seems that the German authorities are taking no notice of the EU legislation and still insist on equipment being built to their own VDE standards. That being the case, I suppose it is logical that Germans would have been told that CE marking has no official status in their country.*

*It also seems to be the case that in many other countries, such as Italy and Spain, the authorities are completely indifferent to whole subject. It's hardly surprising that there is a great deal of confusion over CE marking.*

*The enclosed extract is from a book titled 'The Castle of Lies: Why Britain Must Get Out of Europe', written by two UK journalists who for several years have been collecting examples of bureaucracy gone mad from all over the country. I think the examples quoted give a pretty good idea of the chaos caused here by the CE marking system. I'll leave you to draw your own conclusions.*

Thanks for those comments, Mr Coxwell. You've certainly made some interesting further points — although you're not exactly right about left-hand drive cars being banned here. I've seen quite a few of them on our roads over the years, so they clearly *have* been allowed at least during some period in the past. All the same, I don't think *I'd* like to try driving on our busy roads (especially in Sydney) in a left-hand drive car; it's bad enough in one with standard right-hand drive!

By the way I've read the extract Mr Coxwell included from that book 'The Castle of Lies', and as he says it does indeed paint a picture of 'bureaucracy gone mad' in Europe and the UK with regard to EMC compliance testing. With the subtitle *The Great 'CE Mark' Fiasco*, it starts on page 121 of the book and runs to page 125. If you can get hold of the book, it's well worth a read. ❖

# New Books

## Chip technology

**MICROCHIP FABRICATION, by Peter Van Zant. Third edition 1997, published by McGraw-Hill. Hard covers, 237 x 160mm, 624 pages. ISBN 0-07-067250-4. RRP $168.75.**

The subtitle of this book is 'A Practical Guide To Semiconductor Processing', which is a pretty good summary of what it's about: an introduction to all of the practicalities of making modern semiconductor devices (especially submicron silicon ICs). The author is an engineer, author and trainer with over 30 years' experience in semiconductor fabrication, mainly in Silicon Valley. This is the third edition of a book first published in 1984, but heavily updated and revised since then.

It covers just about every aspect of fabrication, from semiconductor materials through crystal growth and wafer preparation, contamination control, process yields, oxidation, the various steps of photolithography, doping, deposition, metallisation, wafer testing and evaluation, packaging and so on. All of the concepts are covered in satisfying depth, but without a lot of abstruse maths — just enough theory to give you a good feel for what goes on and why things have to be done that way. In short, a sound but essentially *practical* approach.

Some of the drawings and diagrams are a little crudely drawn, and in places it almost screams for a decent colour picture. But on the whole it's well done, and an excellent source of information on this very important area of modern electronics.

Highly recommended for engineering students, newly graduated engineers looks towards a career in chip design and/or fabrication, or indeed anyone with a reasonable science or technical background who wants a good insight into how chips are actually made.

The review copy came from McGraw-Hill Book Company Australia, of PO Box 239, Roseville NSW 2069. (J.R.)

## Surface mount for hobbyists

**A PRACTICAL GUIDE TO SURFACE MOUNT DEVICES, by Bill Mooney. Published by Bernard Babani, 1996. Soft cover, 111 x 177mm, 120 pages. ISBN 0-85934-411-8. Recommended retail price $14.95.**

This is another Babani technical book, and like others in the series, it has a low cost and a pretty good production. This book deals with a topic many hobbyists might think beyond their needs: surface mount components. In fact, these days it's unlikely any serious hobbyist will be able to escape


surface mount technology, including soldering and desoldering these tiny components. And to give you practice, the book includes a number of simple construction projects.

There are a number of books on the market that cover surface mount technology (SMT), but many of these are for professional engineers or for those working at an industrial level. This little book sticks to SMT for hobbyists, covering the sort of soldering and desoldering equipment and techniques hobbyists might use, rather than the hi-tech pick and place machines used in industry.

The book starts by describing typical SMT components, with good diagrams to show their construction and appearance. It then discusses SMT printed circuit board design, and gives a design for an SMT prototyping board.

Also included are circuits and PCB patterns for an audio amplifier and a live wire detector (which detects power wiring behind a wall). Soldering and desoldering techniques, along with the sort of basic equipment needed for these tasks are covered in a subsequent chapter. Included also are construction details for a simple SMT workstation.

Using solder paste and a reflow oven are covered in the last chapter, in which the author makes the point that while a home oven can be used (with great care), it's best to purchase a commercial reflow oven. The appendix includes details of popular surface mount components, as well as a few useful tables, like the complete list of E24 resistors. The review copy came from Jaycar Electronics, and should be available from your local Jaycar store, catalog number BB7055. (P.P.)

## Handbook on DVD

**DVD DEMYSTIFIED, by Jim Taylor. Published by McGraw-Hill, 1998. Soft covers, 234 x 187mm, 444 pages with DVD containing both data and video/audio. ISBN 0-07-064841-7. RRP $89.95.**

Thanks to the widespread availability of both DVD video players and DVD-ROM drives for PCs, plus the greatly improving release of movie titles even here in 'Region 4', the whole subject of DVDs and the technology behind them has become of much greater interest. As a result, this book should have a very healthy market, especially with people like *EA* readers, who generally want to know more about the technical details — the 'whys' and 'hows'.

Author Jim Taylor is IT Director at Videodiscovery Inc., and has a lot of experience in this technology. He was a member of some of the industry groups which helped develop DVD standards, has written various articles about the technology, and seems to have built up a reputation in the USA as a DVD expert.

This book can only enhance that reputation, because it really is excellent. It starts at the beginning, lays a solid foundation of the developments leading up to digital video and the DVD; carefully and methodically explains the technology and clarifies a lot of misconceptions; looks objectively at the strengths and weaknesses of DVD; compares it with other media (both digital and analog); discusses the applications of both DVD-Video and DVD-ROM; and finally looks at future potential and possibilities.

In short, it seems to provide answers to just about all of the questions most of us are likely to ask about DVD — and in a very accessible, satisfying and thorough manner. With plenty of meaty detail where needed, but at the same time sidestepping the risk of becoming bogged down in theory or techno-legalese.

If you want a good reference on DVD, it would be hard to find better. The companion DVD-V/DVD-R disc provides a fair bit of useful demo clips and marketing/explanatory material, too.

The review copy came from McGraw-Hill Book Company Australia, PO Box 239, Roseville 2069. (J.R.) ❖

## THE MASK OF ZORRO: Collector's Edition


**TriStar, 1998. Directed by Martin Campbell, with Antonio Banderas, Anthony Hopkins and Catherine Zeta-Jones. Widescreen, colour, 132m. SS/DL disc, Dolby Digital 5.1; Columbia TriStar Home Video, M15+; RRP $34.95.**

There've been oodles of movies and TV series based on Johnston McCulley's swashbuckling hero Zorro over the years, starting with Doug Fairbanks Snr in 1920. For a long while Rouben Mamoulian's 1940 version with Tyrone Power, Basil Rathbone and Linda Darnell was generally voted the most definitive, but this latest effort has surely knocked it off the pedestal. This one has humour, humanity, rich characterisation, excellent swordplays and stunts, and an expertly paced 'action-with-erotic-undercurrents' story which builds up the tension to a spectacular dramatic climax. In short, just about your ultimate swashbuckler...

The picture and sound quality on this Sony Gold Standard transfer to DVD are really top notch, too. And you get some really good bonus features, as well: a very interesting and informative 45-minute 'making of' feature called *Unmasking Zorro*, a full length commentary by the director, the US trailer, publicity photos and filmographies, and a music video with Tina Arena and Mark Anthony singing the movie's 'I Want to Spend My Lifetime Loving You'.

I didn't really expect to enjoy this one, but I did — immensely. It's very well done, and excellent entertainment in the tradition of Hollywood escapism. (J.R.)

**Picture:** ★★★★★
**Sound:** ★★★★★
**Movie:** ★★★★½
**Bonus Extras:** ★★★★★

## GHOSTBUSTERS: Collector's Edition


**Columbia, 1984. Directed by Ivan Reitman, with Bill Murray, Dan Aykroyd, Sigourney Weaver. Widescreen, colour, 101m. SS/DL disc, Dolby Digital 5.1. Columbia TriStar Home Video, PG; RRP $34.95.**

Written by Dan Aykroyd and Harold Ramis, the original *Ghostbusters* still makes very enjoyable viewing. The tongue-in-cheek humour hasn't aged noticeably, and even the pre-graphics workstation special effects still look remarkably good. It's really quite a classic in the 'spoof supernatural' comedy genre.

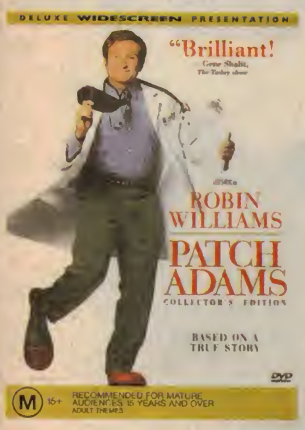
The overall picture quality in this DVD transfer is of a fairly high quality, expecially in the main feature. Colour balance does seem to vary somewhat in the bonus featurette, though. The sound is good too, although the surround channels seem a bit conspicuous by their silence at times.

But the big feature of this disc is the bonus extras, reached via its novel 'buildings on a New York block' menu — and then homing in on the 'Spook Central' building where much of the movie takes place. As well as the usual trailer and audio commentary track behind the feature image (in this case with 'moving silhouettes' of the director and writers, along the bottom), there's a featurette on how the movie got made, a 'scene cemetery' of out-takes, quite a long doco with members of the special effects team explaining how they achieved the spook and dramatic climax effects, storyboards and pictures of the various ghosts, etc — plus the trailer for the sequel *Ghostbusters II*. Quite a collection...

All in all, a very entertaining disc. Murray, Aykroyd, Weaver and Ramis clearly had great fun making it, and the movie happily transfers to the smaller screen. Great viewing! (J.R.)

**Picture:** ★★★★½
**Sound:** ★★★★½
**Movie:** ★★★★½
**Bonus Extras:** ★★★★★

## PATCH ADAMS: Collector's Edition




**Universal, 1998. Directed by Tom Shadyac, with Robin Williams and Monica Potter. Widescreen, colour, 110 minutes. SS/DL disc, Dolby Digital 5.0 surround. Columbia TriStar Home Video, M15+; $34.95.**

Based on the true story of unorthodox US medico Hunter Doherty Adams, who believed in the therapeutic value of humour and establishing a warm human relationship with his patients, this movie has a heart-warming humanity that made in very popular in the cinemas. Robin Williams may be a tad too old for the lead role, especially in relation to Monica Potter as fellow med student and love interest Corin, but basically he just shines — and really makes the movie a success. As well as being good therapeutic fun!

The picture quality on this DVD is excellent, as also is the sound. The bonus features are very good too, although the menu system *is* a tad confusing — both in terms of the colour scheme and the functional design. Often it's not easy to see which menu item currently has the highlight, due to poor colour contrast, and it also takes a while to realise that there's a 'second page' of bonus items like the trailer and cast/filmaker's notes.

Once you do find them all, though, the features are fine. They include a nice 'making of' doco called *The Medicinal Value of Laughter*, with comments from Hunter Adams himself, an audio documentary track by director Tom Shadyac, the US trailer and some quite hilarious out-takes.

This is one movie that makes the jump to DVD and smaller screen viewing very successfully indeed. It's well worth a look, especially if you need a cheer-up. (J.R.)

**Picture:** ★★★★★
**Sound:** ★★★★★
**Movie:** ★★★★½
**Bonus Extras:** ★★★★½

# NEW PRODUCTS

## Components & Equipment

### Low cost UHF CB transceiver

Dick Smith Electronics has released a compact new Kenwood Handheld Transceiver which keeps you in constant touch without having to pay per minute and without the hassle of any contracts or licences. The Kenwood UBZ-LF48 is a compact handheld UHF CB transceiver that provides coverage of the 40 channel UHF CB band with 300mW RF output, repeater access facility, inbuilt selective calling and a flip-down flexible antenna. It's available in either black or yellow.

Affordable and efficient, the transceiver operates for up to 40 hours with three 'AA' batteries. It has a range of up to three kilometres and even more if the repeater function is used. For improved privacy, an inbuilt voice scrambler can be switched on or off as required.


The Kenwood UBZ-LF48 Handheld Transceiver is priced at $199 (RRP) and is available from all Dick Smith Electronics stores Australia-wide and Dick Smith Electronics PowerHouse stores at Penrith, Bankstown, Moore Park in NSW and Carnegie and Nunawading in Victoria. It is also available via mail order by calling Dick Smith Electronics Direct Link on 1300 366 644, or visiting the website at **www.dse.com.au**.

### Improved cordless power tool range

Panasonic has released a new range of professional cordless drill/drivers which incorporate significant advancements in design and performance. The new 'PowerCosmo' Series range offers ergonomic, compact and lightweight design, high power and longer run time, combined with quick charging.

The powerCosmo range includes four models:

- EY6407NQKW, a 12V 13mm drill and driver (3.0AH NiMH battery);
- EY6431NQKW, a 15.6V 13mm drill and driver (3.0AH NiMH battery);
- EY6406FQKW, a 12V 10mm drill and driver (NiCad battery pack); and
- EY6431FQKW, a 15.6V 13mm drill and driver (NiCad battery pack)

The new NiMH (nickel metal hydride) battery pack offers 50% more capacity than the previous NiCad battery pack — providing a longer running time with no change in the size of the battery cell. Battery charging time is 45 minutes, and the battery pack offers long life, with a maximum of 1200 charge/discharge cycles.

Panasonic has reduced the weight of the chucks used in all four models by using lightweight duralumin material. 13mm chucks are 43% lighter, while 10mm chucks are 32% lighter. In addition, reduction in size and weight of the 12V and 15.6V motors have led to improved power-to-weight ratios.

Pricing (RRP) for the new models is EY6407NQKW, $499; EY6431NQKW, $519; EY6406FQKW $469; and EY6431FQKW, $529.

The PowerCosmo Series is available from specialist power tool shops, home improvement centres and electrical wholesalers. For more information, contact Panasonic Customer Care on 132 600.

### Keyboard for mobile phones

The new Ericsson Chatboard is claimed as the ultimate tool for sending SMS text messages and email. It's a pocket sized snap-on keyboard, which connects to an Ericsson mobile phone to make rapid SMS text messaging and email easy. The Chatboard even has its own Internet community website where users can edit their own personal web page on the internet.

Very easy to use, the unit is designed for those who are tired of laborious typing when sending messages from their mobile phone. With its full 'QWERTY' keyboard, there is no longer any need to tap keys repeatedly to create a message. Simply type your message, press 'yes', and it's sent. As well as the full alphabet, the Chatboard includes special 'www', 'phonebook', 'SMS', 'email', and 'attachment' keys so you can even send email and attachments, such as a sound, picture or document, from your Ericsson mobile phone.

The Chatboard Internet site at **www.ericsson.com/chatboard** includes entertaining and useful features such as a personal diary, user bulletin board, on-line chat and games, all designed specifically for Chatboard users.

Small in size and price, the Ericsson Chatboard will retail for around $59.00. It's compatible with the following existing Ericsson mobile phones: A1018s, GF 788e, S 868, SH 888, I 888, R250s, T10s, and T18s.❖

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# COMPUTER NEWS & New Products

## 8X DVD-ROM drive

Hitachi Australia has announced the local availability of its fifth generation DVD-ROM drive, featuring almost universal media compatibility and vastly increased speed. The Hitachi GD-5000 is an internal, half-height DVD-ROM device that offers an 8X maximum DVD-ROM speed and up to an amazing 40X CD-ROM speed with full CAV.

The GD-5000 is an enhanced IDE (ATAPI bus) interface DVD-ROM device supporting a large look-ahead buffer and high data rates via Ultra DMA. RPC phase 2 is also supported and the unit is specially designed for low noise and vibration.

Perhaps the most exciting feature is the GD-5000's ability to read DVD-RAM discs. A single sided 2.6G byte DVD-RAM disc with pre-recorded images or data can now be inserted (bare) into the GD-5000 and read. This means, for example, that a single more expensive DVD-RAM drive can be used by a company to record and store complex and large CAD drawings or art copy onto a Type II DVD-RAM disc, which can then be replayed on any GD-5000 throughout that company. At last inexpensive data universality on the desktop is possible.

The new Hitachi GD-5000 fifth generation DVD-ROM drive is available from Australian dealers for a suggested RRP of $279.00 including tax.

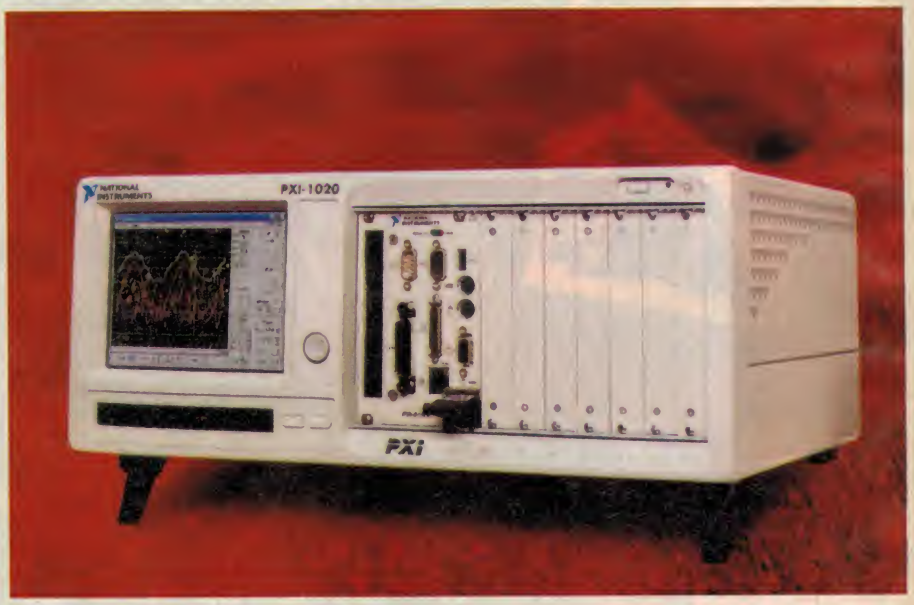
## Four-way signal selector

The Knurr Signum Plus EC is a signal selector for video, keyboard and mouse signals, suitable for all applications requiring central command of a maximum of four computers from one console.

The unit emulates a keyboard and mouse for all the connected computers. This means there are no problems when all the computers connected to the selector log on simultaneously and fail to find a keyboard and/or mouse.

Special high-quality cables guarantee image quality at resolutions of up to 1280 x 1024 pixels. Power supply to the Knurr Signum Plus is provided by the connected computers. This ensures operation as long as at least one computer is connected. An integrated autoscan function permits channels to be switched automatically for cyclical monitoring of all the connected computers.

For more details contact Ricon, Unit 1, 32 Lilian Fowler Place, Marrickville NSW 2204.




## First FireWire data acquisition device

National Instruments has announced what is claimed as the world's first data acquisition device (DAQ) for the IEEE-1394 serial bus (FireWire). The DAQPad-6070E multifunction I/O device connects directly to Windows 98 PCs equipped with an IEEE-1394 serial port or PCI-to-1394 adapter. The device offers engineers and scientists a portable, easily installed and configured solution for their computer-based measurement applications.

The DAQPad-6070E comes with the company's NI-DAQ driver software and integrates seamlessly with its industry-leading measurement and automation software, including LabVIEW, LabWindows/CVI, and ComponentWorks. It features a 1.25MS/s sampling rate; eight digital I/O lines; 12-bit A/D resolution; two 24-bit counter timers; 15 analog inputs and two analog outputs.

As a FireWire product, the high-performance DAQPad-6070E is hot-pluggable and delivers easy plug and play configuration. To conform to the FireWire specification, the device must be located within 7km of the bus socket. However, engineers and scientists can daisy-chain up to 16 devices to span a maximum distance of 115km. (For more information about IEEE-1394, visit the company's new Technology 2000 - Engineering in the New Millennium Web site, at **www.ni.com/tech2000**)

The DAQPad-6070E is available in two different configurations: mass termination or BNC termination. The mass termination version offers a low-profile package that fits under most laptop computers. It features a 68-pin shielded connector to connect signals from the company's signal conditioning products, including the SCC Series modular components and the CA-1000 custom connectivity enclosure. The BNC termination version is ideal for applications where portability and quick connectivity is needed, such as in-vehicle testing. The DAQPad-6070E includes an AC to DC power adapter and an optional rechargeable battery pack or 9 to 25VDC supply.

For more information contact National Instruments Australia, PO Box 466, Ringwood 3134.

## Mobile Pentium from Sharp

Sharp Corporation claims its new PC-A500 notebook PC, which comes complete with high performance Mobile Pentium Processor, expandable 64MB SDRAM and 6.4GB hard disk drive, has the power and ability to meet any challenge. A flexible Expansion Bay accommodates a CD-ROM drive, floppy disk drive or optional second battery, but when those extra capabilities are not required, the user can insert a 'weight saver' to make the PC lighter to carry.

Moreover, unlike other approximate 'A4' size notebooks on the market, the PC-A500 really has been trimmed down to exact A4 dimensions and weighs in at just 1.98kg. Sharp's revolutionary low reflection and pure black 12.1" TFT LCD ensures super bright, high resolution images whatever the lighting conditions.

In addition to the standard connection ports in a top-of-the-range laptop, a monitor port for connecting external display equipment such as LCD projectors has been included to make outstanding business presentations easy. An infrared port ensures cable free transmission of data to and from personal organisers, desktops and handheld PCs.

The Sharp PC-A500 has an RRP of $4995 including sales tax.

For more information contact Sharp Corporation of Australia, 1 Huntingwood Drive, Huntingwood NSW 2148.

## System crash recovery software


Adaptec has announced ReZOOM, claimed as the first software program that instantly reboots, repairs, and restores valuable data from a secondary backup drive in the event of a system failure. ReZOOM eliminates critical PC downtime and products user productivity by allowing the user to reboot and resume work after a system crash with just one keystroke. ReZOOM's repair wizard will also automatically diagnose and repair the most common software corruption problems on the primary drive while the user continues to work.

"ReZOOM software is designed for business users who are too busy to backup everyday, can't afford downtime, and need guaranteed access to PC-based documents, applications, and the internet", said Malcolm Parsons, Adaptec Country Manager for Australia/New Zealand. "With one keystroke recovery, all selected system, application, and data files are always available without having to wait for a help line or IT support."

For maximum flexibility, ReZOOM can use common IDE disks as well as internal or external SCSI hard drives.

During the setup, the applications, folders, and data to be protected are selected and backed up. From there, ReZOOM works continuously in the background maintaining a copy of these updated files as well as copying any new documents that have been scanned and stripped of software problems or viruses.

If the user's primary drive has a serious software or hardware problem and must be replaced or repaired, it can be removed and the user can continue working from the ReZOOM backup drive. For maximum flexibility, ReZOOM can use common IDE disks as well as internal or external SCSI hard drives.

ReZOOM has an RRP of $129 and is available from Agate Technology (02) 9878 4688 and Tech Pacific (02) 9381 6000. For more information visit the web site at **http://rezoom.adaptec.com**. ❖

# Webwatch

BY GRAHAM CATTLEY

Due to popular request, I've collated a list of all the sites ever covered in Webwatch, and it is available for download from our web site in the Internet files section. You can save the file on your own system, and use it as a handy reference, and download the update every month. And if you know of any sites that you feel deserve a mention in Webwatch, drop me a line at gcattley@fpc.com.au, and I'll be happy to include them in an upcoming column.

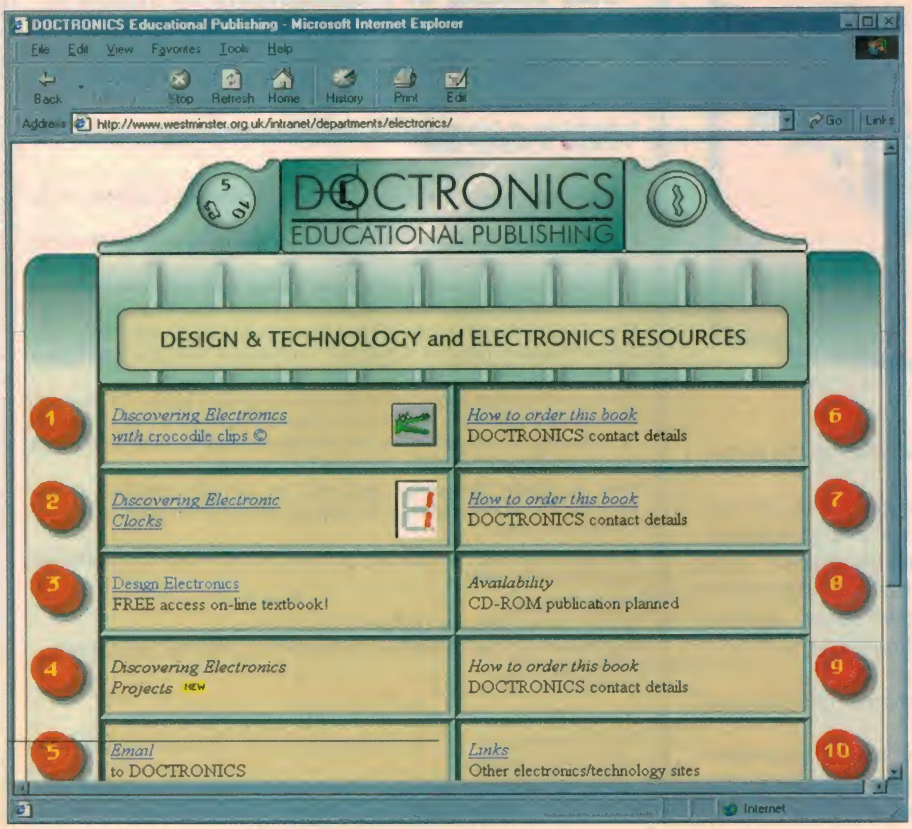
I WAS PUT ON TO the Doctronics website **(http://www.westminster.org.uk/intranet/departments/electronics)** by EA reader Jesse de Vries, who said that anyone with any interest in the workings and further application of the 555 or 4017 should see it.

I agree, and would also add the 4000, 4002, 4011, 4012 to that list as well.

The site is actually the home of an online version of the Design Electronics textbook by W.D Phillips, and it covers most of the contents of the printed version.

There are chapters on resistors and voltage dividers, making a capacitor, using an oscilloscope and multimeter, and how to prototype circuits.

There's also a very good section on 'Signals', that covers Sine, square and other waveforms, and goes into a bit of maths to explain it all. And explain it all it does, because the quality of all the diagrams used on the site are excellent. Clean, clear line drawings abound of waveforms, components, and even the internals of a prototyping board.


As Jesse said to me in his email, "This guy really is doing an awesome job, and I'm sure you'll agree he deserves a bit of publicity...." I do, so I strongly suggest that you go and visit.

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I BET YOU DIDN'T KNOW that anyone even studied snake locomotion, let alone build robots to emulate it.

Sure enough someone does, and has, and what's more, he's put it all on the web for the world to see at **http://www.snakerobots.com/**. Most of the snakes are slightly larger than life size, except for 'S5', who boasts double the number of segments of the other robots, and resembles the length to width ratio of a real snake. S5 also boasts two 20MHz Basic Stamp II microprocessors, One 50MHz Scenix Microprocessor, 64 servos, 8 servo control units, 42 batteries and a four-channel radio control.

The best thing about the site are the MPEG movies. These are great — big, but great. The file size runs from 1.5 to 6MB, which is a significant download (unless, like me, you have an ISDN connection at work...), but it is worth it. Particularly spectacular is the movie of S3 slithering along and then sidewinding — the programming involved must have been horrendous.

The author doesn't seem to have much else going on in his life, as you'll also find on the site a poem he wrote about a snake, a picture of a snake he met in Bali, and links to other snake robot sites. Most worrying is the information he supplied on S3: it was the ring-bearer at his wedding...

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SO, WHAT'S ALL THIS about Digital Television coming to Australia? If you are looking for information on this topic, it would be worth heading on over to **http://www.zipworld.com.au/~quokka/dtvaus** where Robert Simons has set up his 'Digital Television in Australia' site. He's a student at the University of Wollongong, studying Information and Communication Technology, and he seems pretty clued-up on the subject. He covers DVB-T, the 'Cliff effect', potential pitfalls of going to digital, surround sound and so on. He also covers things like what to do with your current TV, VCR etc., and what will (or won't) be compatible.

As I said, Robert knows what he's talking about, and he puts it across in friendly, helpful manner. It's a good informative site, and well worth visiting.❖

## NEW SUPER LOW PRICE + LASER AUTOMATIC LASER LIGHT SHOW KIT: MKIII.

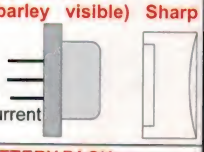
Automatically changes every 5 - 60 secs. Countless great displays from single to multiple flowers, collapsing circles, rotating single and multiple ellipses, stars, etc. Easy mirror alignment with "Allen Key". Kit inc. PCB, all on board components, three small DC motors, mirrors, precision adjustable mirror mounts: (K115) + very bright 650nM laser (LM2) module. Kit with laser module $60 Kit + laser module + plug-pack + instument style case all at a special price of $75

$60

## IR LASER DIODE SECIAL

**5mW 780nM (barley visible) Sharp LTO26**

Requires 65mA. Diode plus focus lens (no housing) $18....constant current driver kit $10



## LITHIUM-ION BATTERY PACK AUDIOVOX BTR600R 400mAh 7.2V

These battery packs contain two rechargeable Lithium-Ion cells, with an amazing 400 mAh capacity in such a small cell (51mm X14mm). Ideal for use as R/C receiver batteries etc. $4ea

## KEY-CHAIN LASER POINTER

in a presentation box. Quality metal housing + 3X LR44 /AG13 bats. **FREE.** Extra bats. 50c Ea

$10

**Line lens+$0.80...X-hair lens ( + ) $0.80...Module (no case) only $8**

## ***X-MAS SPECIAL***

## NIGHT VISION

**35-140 LED INFRA-RED ILLUMINATOR KIT**

Comes on when it gets dark or can be controlled by alarm system. 20-30M range Kit inc mount ing tray & universal swivel mount. 35 LEDs $25. Extra 35 LED pack (3extra packs max) $14 per pack. 140 LED kit: $67 **OR** base Kit + 105 extra LEDs, **140 LEDs TOTAL!!!** for just $50. Use with B/W cameras to see in the dark.

$25

## USED AUSSIE MADE TRANSFORMER

240V PRIMARY (120+120),ES screen, Secondary....1X12V@1.1A...10V@5A...7V@ 5A... 12-0-12V@7.5A. 100 X 115 X 100mm. bargain at $15

## NEW FULLY FEATURED ANSWERING MACHINES.

Brand new in original box with manual, tape, plug pack and phone lead Call screening, up to 2.5 min. out going message, VOX recording, power fail protection, memo record, plays music before beep, digital volume control, programmable security code, remote call break-through, room monitor, full remote features, save messages, AUSTEL appd. Bargain at $25

$25

## TOLL FREE PHONE NUMBER

Sorry but we don't have one but if you call **02-95843564** 24hrs & leave a message & your number we will call you back ASAP at our cost. NO MOBILES. STD AND NZ OK **(ORDERS ONLY)**


## OATLEY ELECTRONICS

**ACN 068 740 081**
**PO Box 89 Oatley NSW 2223**
**Ph ( 02 ) 9584 3563 Fax 9584 3561**
**e-mail orders: sales@oatleyelectronics.com**
**www.oatleyelectronics.com**
***major cards with ph. & fax orders,***
**Post & Pack typically $6**
**Prices subject to change without notice**


## *****PLEASE NOTE OUR NEW EMAIL ADDRESS *****

**iF YOU DON'T CHECK OUT OUR BARGAIN CORNER REGULARLY YOU COULD BE MISSING OUT ON SOME GREAT BARGAINS LIKE....**

Medical X-Ray machine $1500...Industrial X-Ray machine $1500... Labmaster Salt Spray Environmental Reliability Tester $2500...10Mhz-18Ghz synthesised signal generator $1600... Multicore Solders Vaporette to solder surface mount components to the PCB...$450...NEC Port Replicator 2400 (Model: OP-560-65001). Connect all your peripherals to your NEC 2400 notebook $25...Iomega ZIP Tools Accessory Kit $15...Multi-tone Siren $15...NEC 14" Autosync Color Monitor $120...mobile phone accessories. Just too many items to list here.

## CCD NIGHT VISION!!!

**Why buy a "low end (relative junk) Russian night viewer with which you can generally see about the same as with your own eyes? Cant afford a 2nd / 3rd generation viewer for 1000's of dollars? Both of these are fragile and have limited life! our viewers use a sensitive CCD camera, a high power IR illuminator and a 4" monitor. the unit is hand held but requires a rechargeable gel battery in a shoulder bag / bum bag to operate. You don't need moonlight or even starlight, it will work in total darkness with a range of up to 30meters!! what's more it is not fragile. The unit can even be used in full sunlight!! increadable low introductory prices! Click on CCD NIGHT VISION at...**

**oatleyelectronics.com**

## PC MOTHER BOARD SPECIAL

40MHz - 486 new in original packaging with booklet 3 for $30 or $15 ea.

## NEW ULTRA-SONIC RADAR KIT

This U/S radar can sound a buzzer or flash a light on your dash to let you know when your car is near another car or object. Inc. adj. upto1M. Can drive a relay or buzzer. kit inc. PCB + all on-board parts including Ultra-sonic transducers and buzzer for $16

## ***NEW*****NEW*****NEW*****NEW***

## QUALITY AUSTRALIAN MADE FEATURE PACKED MINI ALARM SYSTEM.

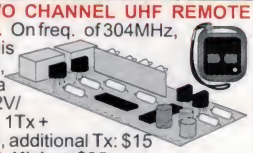
Features inc. boot release, central locking output, imobiliser output, indicator flash relay. Has with 2 key-fob transmitter keys.

$99

Drawn in proportion

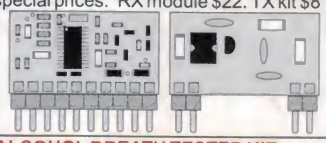
## ONE / TWO CHANNEL UHF REMOTE CONTROL

On freq. of 304MHz, transmitter is assembled, receiver is a kit, inc. 2 12V/ 12A relays, 1Tx + 1Rx kit:$45, additional Tx: $15 **1 CHANNEL Kit just** $25



## UHF DATA TRANSMISSION

Stamp sized Xtal locked 433.9MHz superhetrodyne receiver module. Small matching transmitter kit:(K122) All at special prices. RX module $22. TX kit $8



## UHF AUDIO / VIDEO TRANSMITTER KIT

Kit includes all components needed..... PCB plus all on-board components, connectors, switch, metal case, telescopic antenna, twin RCA A/V lead, all that is needed to complete the full kit. 12Vdc @10mA operation. Ideal for transmitting audio and video around you home.. Complete Kit for just $28

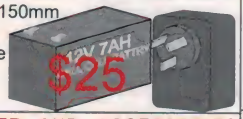
suitable plugpack $5

## USED AUSSIE MADE TRANSFORMER

240V PRIMARY (120+120),ES screen, Secondary....1X12V@1.1A...10V@5A...7V@ 5A... 12-0-12V@7.5A. 100 X 115 X 100mm. bargain at $15

## WE HAVE FRESH STOCKS OF NEW 12V / 7Ah GEL BATTERIES

Priced at a fraction of their real value. 65mm (W) X 150mm (L) X 94mm (H),+ suitable trickle charger.



$25

## ALCOHOL BREATH TESTER KIT:

Ref: EA Oct. 96. Based on a high quality Japanese thick film alcohol gas sensor. The kit includes a PCB, all on board components and a meter movement: (K80) reduced from$40 to &25

## VIDEO CAMERAS

### HOUSED CAMERAS

**CMOS DOME COLOUR $160**
**CMOS COLOUR IN A SWIVEL CASE $160**

### PCB CAMERAS

**B/W CCD CAMERAS $89** pinhole (60deg.), 92 deg,120 deg. add $10 for 150 deg.
**CCD COLOUR $190**
**SUGAR CUBE CAMERAS $70**
**ALL WITH A FREE VHF MODULATOR & SUITABLE PLUG PACK**

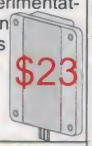
$160 $70

## CAMCORDER AND ACCESSORIES

**NiCad. BATTERIES 6V 2400mAh. Multi-fit type.** These are new and in original pack. Two types. One type (sbc5223) fits CANON, BAUER and equivalent. The other (sbc5225) fits HITACHI, SABA, MINOLTA, RCA and equivalents. Just a fraction of the retail price at $30

## MICROWAVE DOPPLER TRANSCEIVER (movement detector)

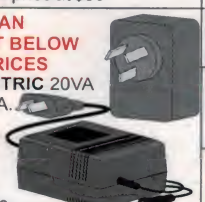
5VDC operation @ 50mA. Operates at 10.525 GHz. can be pulse mode operated. Uses include alarms,radar experimentation, auto-matic doors, obstruction de-tection for vehicles and robots etc. and lighting control as you enter or leave a room. Super special introductory price of $23or 2 for $40



$23

## NEW AUSTRALIAN PLUG PACKS AT BELOW WHOLESALE PRICES

**GENERAL ELECTRIC** 20VA 14VDC @ 700mA.
**AUDIOVOX** 9V @ 500mA
**AUDIOVOX** 12V @ 400mA....
$5 Ea. or 5 for $20



## FLASHING MOBILE ANTENNAS

suit most popular mobile phones.1 / 3 LED (RGB) $3.50 / $7.00

## **LOOK AT THIS**

**12V- & 24V DC CFLs**
**12V-13W $25 24V-10W $23**
**Ideal for solar systems, caravans, safety lead light for car repair workshops etc.**

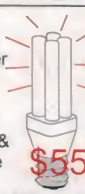
## RADIO CONTROL MODEL SPEED CONTROL KIT

This kit is designed to work direct from a STD 1-2ms pulse from a R/C receiver to control an electric motor (in one direction only). Kit includes PCB + all on-board components inc. 5 high power MOSFETs, a wiring kit and fuse holder & 26 x 64 x 38mm case. Features include brake. Don't pay $150 for commercially available one Coming soon for less than $35

< $35

## CFL INVERTER KIT

our very popular inverter. The improved design uses a larger transformer and a SG3525 switch Mode Chip.This very Efficient Driver kit can drive a number of CFL's from 12vdc. & would be great for lighting the weekender or caravan..
**SPECIAL** 1 inverter & 3 CFLs: $45



$55

## PELTIER EFFECT DEVICES

Could be used for cooling overclocked PC CPUs. All 40 X 40mm.
4A △ T 65deg. Qmax 42W $25
6A △ T 65deg. Qmax 60W $27.50
8A △ T 65deg. Qmax 75W $30
Comes with info to build cooler / heater plus data. Some used heatsinks avail.

## TWO MOTOR LASER LIGHTSHOW KIT

Inc. motors, mirrors, reversing switch & all electronic components. Can be controlled by variable DC input. Lots of patterns, flowers, stars etc. $16 **Laser module $8**

## 5KHz OSCILLOSCOPE $25!!!

Ref EA Aug. 96. Kit Connects to your PC parallel port & samples over 0-2V & 0-20V @ between1 per hour to 1per 100uS. Ideal to monitor battery charging etc. or used as a basic 5KHz oscilloscope! Our kit inc. all onboard components, PCB, box & software on 3.5 disk:(K90) $25

## 15A PLUS 12V/24V HI EFFICIENCY SOLAR REGULATOR KIT

Our regulator suits up to 100W panels. Features precision voltage ref., Hi eff. saturating MOSFET, Shotky diode isolation, charge indicator and a current limiter so it can be used with car battery chargers, generators etc. Low cost due to the use of some unused recycled components. complete kit inc. case $29... See our bargain solar panels in this ad..

## MUSIC BOX KIT:

Ref: EA Oct. 96. This little kit is the electronic equivalent music box. With a range of tunes & is activated by light. Use it in a music box, a musical jewellery case, or toys. Req. 2 x AA batteries. Kit is supplied with PCB, all on-board components, a small speaker and battery holder. Kit is available in two different versions;
*Xmas Songs + M3481 IC: (K78C) $11
*Various Songs + M3485 IC: (K78V) $11
* Additional (M3481 or M3485) $3.50 each

## SOLAR PANEL / FAN SPECIAL

SIEMENS brand Poly crystalline cells. Voc Isc 1W output. 4 panels req. to charge 12V batteries. Specs: Open circuit voltage: 5.7v...Short circuit current: 0.22A Peak Power: 1.0W @ 100mW / sq cm. 160mm x 55mm x 5mm...Flying lead: Dual cable 25cm. Place under glass for outdoor use.$10ea. or 4 for $36...
**PANAFLOW 60mm 12Vdc fans.**
$3 ea or 4 for $10
**Or 1Fan + 1 Solar Panel** for the combined bulk prices...$11.50...One of these solar panels will run one of these fans in overcast conditions.

## 16 X 2 line LCD display $12ea/3 for $30:

Soft ware to drive display from a PC from Silicon Chips web site


AUDIOWORKS
breathtaking sound...
MERIDIAN
thunderous cinema effects...
LUXMAN
KEF
music at its purest...
CELESTION
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member
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audioquest
AUD1536